

#### **Annual Programs Review**

April 19-20, 2005

#### **Annual Program Review Agenda**

#### Tuesday, 19 April 2005

Open Remarks: "Interdependency Across the Services", by Rear Admiral Timothy L. Heely, USN, PEO for Strike Weapons and Unmanned Aviation

Keynote Address by Major General Joseph F. Peterson, USA, Vice Director for Operations (J-3), The Joint Staff (Presentation not approved for distribution)

#### **Precision Attack to Ensure Dominant Maneuvers:**

- EXCALIBUR XM982, by LTC Bill Cole, Product Manager for Excalibur
- Non-Line-of-Sight Launch System Program Update, by Mr. Rod Summers, Director, NLOS-LS Task Force
- Guided MLRS Full Spectrum Precision with Scalable Effects, by LTC Stephen Lee, Product Manager GMLRS, Precision Fires Rocket & Missile Systems (PFRMS)
- Viper Strike Fielded and Ready! by LTC John Oxford, USA, PM Submunitions

Precision Weapons Capability from an Operator, by Lt Col West "Elvis" Anderson, USAF, Student, National War College

#### Wedensday, 20 April 2005

Laying the Geospatial-Intelligence Foundation for Future Warfare, by Mr. Jon D. Estridge, Chief, Air Warfare/Targeting Division, NGA Future Warfare Systems (IW), InnoVision Directorate

#### Joint Deep Strike Systems:

- JASSM, by Colonel James Geurts, Commander, Long Range Missile Systems Group
- NETWORKING WEAPONS: Weapons Data Link Network Advanced Concept Technology Demonstration, by Ms. Lynda Rutledge, AAC/XR

Capabilities Based Planning: An AT&L Perspective on FCB Interactions, by Mr. James "Raleigh" Durham, Deputy Director for Joint Force Application, OUSD(AT&L) Defense Systems

LUNCHEON ADDRESS: Improving the Kill Chain, by Lieutenant General Michael A. Hough, USMC Deputy Commandant for Aviation United States Marine Corps Headquarters

#### **Precision Strike Acquisition Panel:**

- Army Prespective: "US Army Precision Fires", by BG(P) Jeff Sorenson, USA
- Air Force Perspective: Armament for the Battlefield, by Ms. Judy A. Stokley, Deputy for Acquisitions, Air Armament Center

# Precision Strike Association ANNUAL PROGRAMS REVIEW—April 19-20, 2005

#### **TUESDAY, 19 APRIL**

**OPENING REMARKS:** Rear Admiral Timothy L. Heely, USN

PEO for Strike Weapons and Unmanned Aviation

**KEYNOTE ADDRESS:** Major General Joseph F. Peterson, USA

(Presentation not approved for distribution)

Vice Director for Operations (J-3), The Joint Staff

#### PRECISION ATTACK TO ENSURE DOMINANT MANEUVERS:

- EXCALIBUR: LTC Bill Cole, USA
   Deputy PM, Combat Ammo System
- NLOS Launch System & NLOS Cannon: Rod Summers—PM, NLOS-LS
- Guided MLRS: LTC Steve Lee
   PM, Guided MLRS Unitary
- VIPER STRIKE: LTC John Oxford, USA
   PM

#### **TESTING OF PRECISION STRIKE WEAPONS: David W. Duma**

Acting Director, Operational Test and Evaluation, OSD

THE B-1 & PRECISION STRIKE WEAPONS: Lt Col West Anderson, USAF Student, National War College

## WARFIGHTERS' STRATEGY PANEL—POLICY IMPLICATIONS FOR THE FUTURE OF PRECISION STRIKE WEAPONS: (No Presentations)

Army Perspective: BG (P) Robert E. Durbin, USA
 Director, Army QDR

- Navy Perspective: RADM Patrick M. Walsh, USN
   Director, Navy QDR Support Office
- Marine Corps Perspective: MajGen Emerson N. Gardner, USMC Director, USMC QDR
- Air Force Perspective: Brig Gen Taco Gilbert, USAF
   Deputy Director, Air Force Strategic Planning Directorate

#### **WEDNESDAY, APRIL 20**

## IMPROVING TARGET LOCATION ERROR THROUGH CONVERGENCE OF GEOSPATIAL

#### & TACTICAL INFORMATION: Jon Estridge

InnoVision Directorate, Targeting & C4ISR Division Chief, National Geospatial-Intelligence Agency (NGA)

#### **JOINT DEEP STRIKE SYSTEMS:**

- JASSM: Colonel James Geurts, USAF JASSM PM
- ATACMS: Colonel Earnest Harris, USA
   PM, Precision Fires Rockets & Missiles, PEO Space and Missiles
   Command
- TOMAHAWK: CAPT Bob Novak, USN (Presentation not approved for distribution)

PMA-280

 Network Weapon ACTD: Linda Rutledge NCW PM

**SEA STRIKE SYSTEMS:** Weapons in the GiG (FORCENET): "It's all about the kill chain" or "getting targeting information to the proper lethal mechanism" (No Presentations)

 Strategic/Operational Perspective: CAPT Bob Novak, USN PMA-280 Operational/Tactical (Fixed Wing Strike) Perspective: CAPT David
 Dunaway, USN

PMA-201

- Tactical (Direct Attack) Perspective: CAPT Mark Converse, USN PMA-242
- Requirements Perspective: LtCol Chris St. George, USMC N78

#### **LUNCHEON ADDRESS: Lieutenant General Michael A. Hough, USMC**

Deputy Commandant for Aviation United States Marine Corps Headquarters

#### FUNCTIONAL CAPABILITIES BOARD PROCESS—FORCE APPLICATION:

#### Raleigh Durham

Deputy Director for Joint Force Application, OUSD(AT&L)/DS

## **KEYNOTE ADDRESS:** General Benjamin S. Griffin, USA (Presentation not approved for distribution)

Commanding General, U.S. Army Material Command

#### PRECISION STRIKE ACQUISITION PANEL:

- Army Perspective: BG(P) Jeffrey Sorenson, USA
   Director, Systems Management & Horizontal Technology Integration
- Naval Perspective: RADM (S) Rick Wren, USN (No Presentation)
   Aviation & Aircraft Carrier Plans & Programs N-780
- Air Force Perspective: Judy Stokley
   Deputy for Acquisition, Air Armament Center, Eglin Air Force
- OSD Perspective: Diane Wright (No Presentation)
   OUSD (AT&L) Defense Systems, Air Warfare Director
- National Agency Perspective: Scott Robertson
   Director, Future Warfare Systems Office, National Geospatial-Intelligence
   Agency (NGA)











### **Overview**

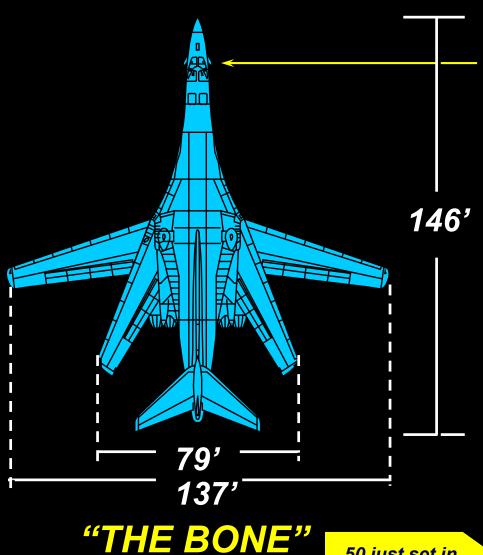


- Precision and "Block D"
  - OEF & OIF results
- Precision and "Block E"
  - Capabilities & Proposals
- B-1 Weapons Roadmap
- Thoughts on Optimal Design Capabilities



## **B-1** General Description





Crew
2 Pilots & 2 WSOs

#### **Performance Data**

Cruise Speed: .65 - 1.2M
Altitudes: 200 ft - FL 350
Range: Unlimited with Air
Refueling
All Weather
Day/Night Terrain Following

100 world records for aircraft speed - payload - distance and time to climb.

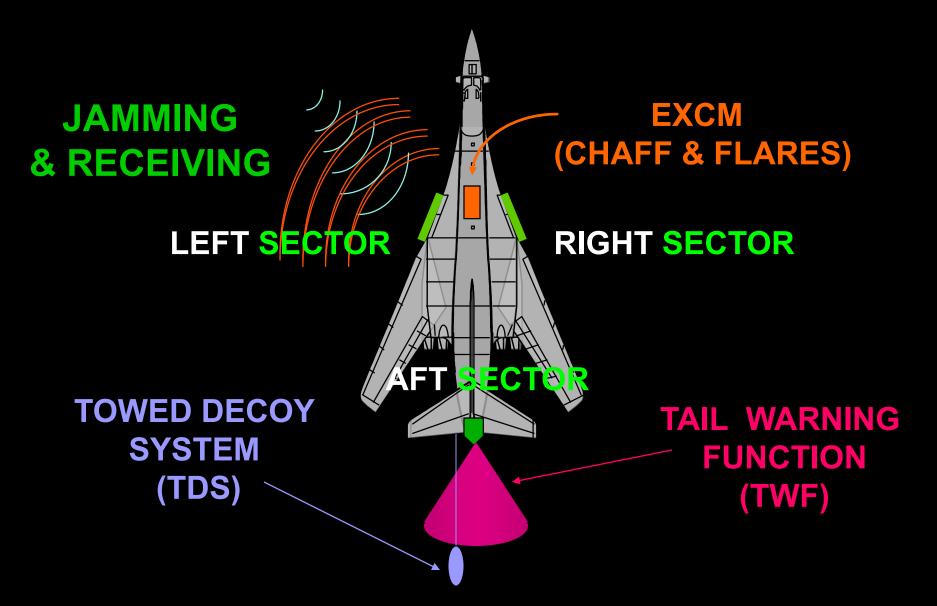
The B-1 currently holds

50 just set in October 2003



### **Defensive Avionics**

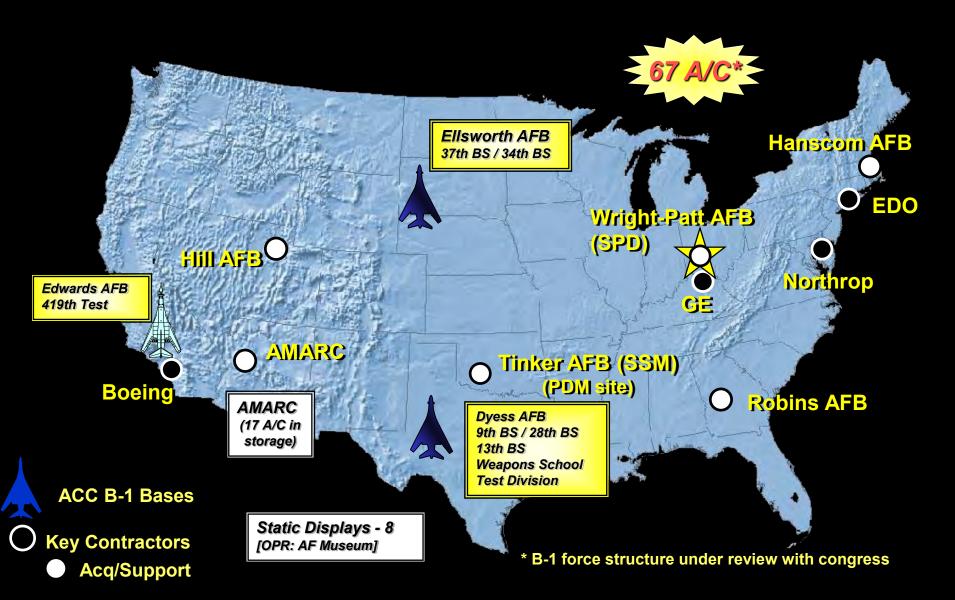






# Aircraft Basing







### **B-1 Mission Evolution**

**USAF Bomber** 

Roadmap

(June 1992)



### Cold War B-1

Nuclear Deterrence

Low-altitude, high speed

Pre-planned, SIOP missions

CONUS based, nuclear alert

Today's (and Tomorrow's) B-1

Conventional Engagement

High-altitude, loiter & strike

In-flight mission planning / targeting

CONUS based, rapid deployment

Heavy strike platform with a new generation of conventional weapons



# Block D

# ST S

*MilStd-1760 / GPS / JDAM / ARC-210 / TDS...* 

- Integration of JDAM (24 per B-1)
  - GBU-31 (Mk-84) and GBU-34 (Blu-109)
- Mil Std 1760 bus interface / GPS
- ALE- 50 Towed Decoy System (TDS)
- GMTI/GMTT mode (non-integrated to crosshairs)
- ARC-210 Radio



 RAA declared Dec 98 - operational in OAF, OEF & OIF





ALE-50
Towed Decoy



- RF repeater
- Increases missile miss distance by decoying missile away from B-1



# B-1 WEAPONS "Blk D"



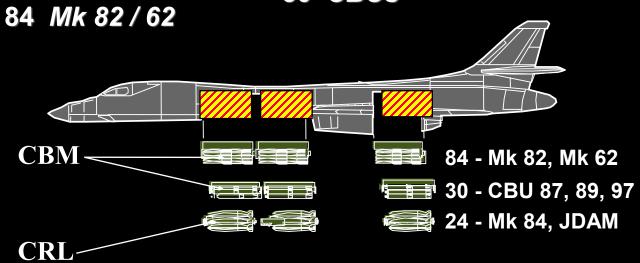






30 CBUs

24 JDAM / Mk 84





# Expeditionary Air Force



- 10 AEF "Buckets"
  - Full range of capabilities
- Global response
- CONUS to bare base to combat ops in min-time
- Deployment target length = 90 days
- Bombers were key in AEF









# Operation ENDURING FREEDOM



The Nation Calls...

- Sept 11 Response War on Terrorism
  - Oct 2001 Ongoing / Afghanistan
- B-1s dropped 38% of all weapons dropped while flying only 5% of the overall sorties
- B-1s dropped twice as made JDAM as all the rest of mid aircraft <u>combined!</u>

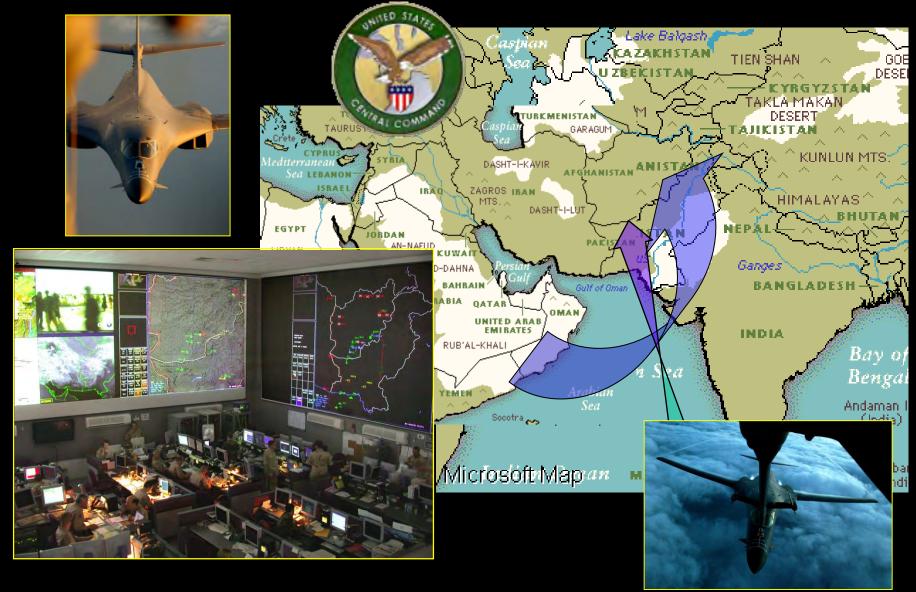




# **AOR**



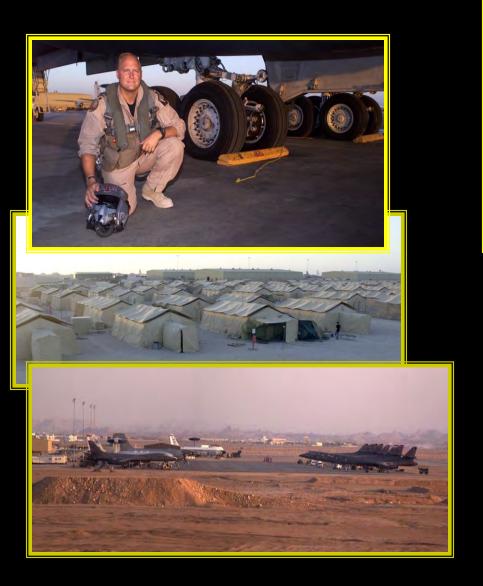
### Long Range Airpower the Key...





# **Expeditionary Mindset**







- Built base from scratch
- Start with some slabs of concrete
- Add equipment, combat
   CE and hard work
- Include services skills
- All the amenities of home
- Ready to fight



## GBU-31 JDAM

#### the Big Stick...



- Joint Direct Attack Munition
  - GPS-Aided GP / Penetrator
  - − Weight: ~ 2000 Pounds
    - Mk-84 or BLU-109 Bomb Body
  - Length: 12.7 Feet
  - Guidance: INS / GPS-Aided
  - Range: ∼8 NM
- B-1 Carriage: 24
  - 8 JDAM per Bay
  - 3 versions (Impact, Air Burst,
     Penetrator

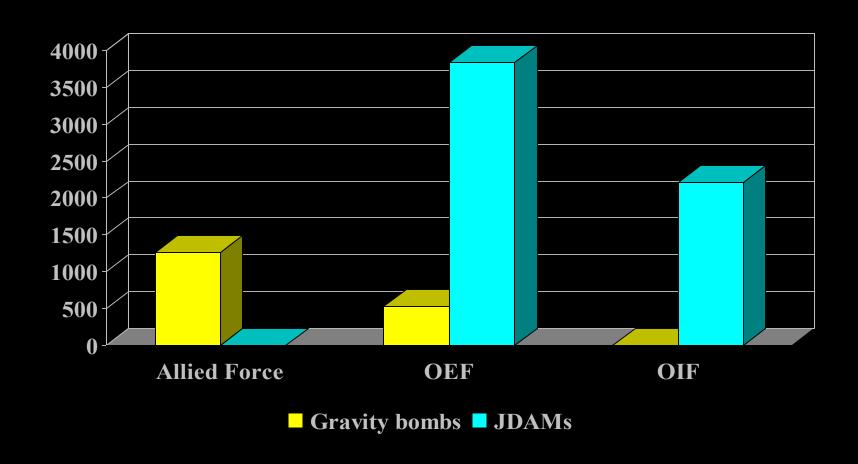






# Weapons Expended (Tons)







# Combat Performance













# B-1 operations from Oman



- Take-off fully loaded with 24 JDAM and climb to altitude
- 6 sortie surge with 3-4 sustained ops per ATO
- Enter into combat box
  - 2-5 hours on station
  - Usually one air refueling
- On-call for strategic attack, interdiction or CAS mission
- Also conducted PSYOPS!









### **OEF**







### **B-1 Operations from Diego Garcia**





#### Average Crew Duty Day:

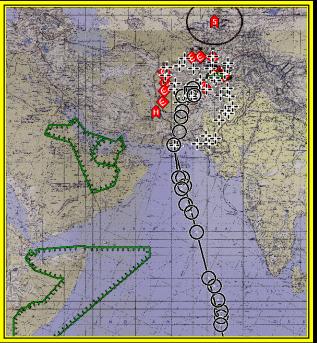
• 22 Hours

#### Load-Out

- 16 JDAMs
- 1 Fwd Bay Tank

### Average Sortie Duration:

- 16-18 Hours
  - 430k lbs. GW on Takeoff
  - 4-5 Hour Vul Coverage
  - 3 Midair Refuelings (90, 90, 65)
  - Longest B-1 Combat Sortie in History
    - 21.3 Hours, 11 Hour Vul Period

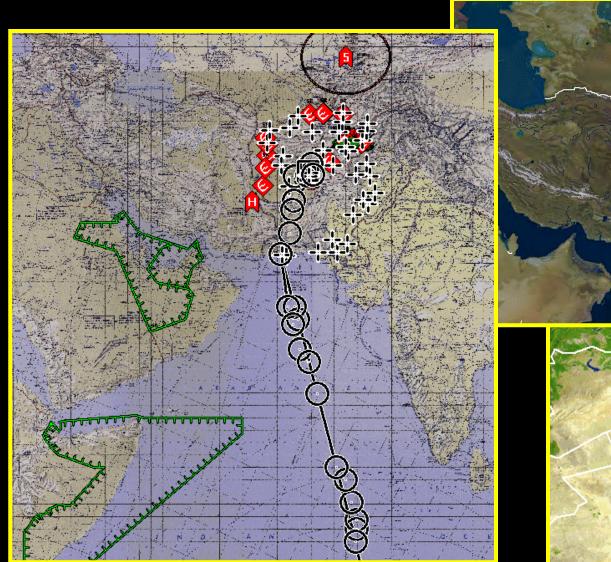






# Mission Routing Operation ENDURING FREEDOM & IRAQI FREEDOM...











# A Very Long Way....



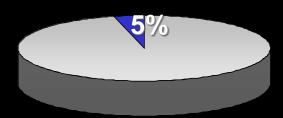




# The BONE's Contribution



Product of Precision and Payload...



- All other aircraft
- **■** B-1

**Sorties Flown** 



35%

**Weapons Dropped** 



**Targets Destroyed** 



"We're not running out of targets, Afghanistan is....."

- Secretary of Defense Rumsfeld



## Operation ENDURING FREEDOM



CFACC's Platform of Choice...

#### Weapons Dropped:

JDAMs 3660 and rising

Mk-82s 1,471

Mk-84s 135+

CBU-87 70





- 1	1 1

B-1	3,438	41%
B-52	3,089	32%
All Others	2,538	27%



# Adaptive Warfighting



- Transforming the B-1 during warfare
  - On Call CAS
  - Psyops
  - ISR
  - TST / Emerging Targets
    - Leadership, High Value,
       Strategic Effects
  - Strike Coordination and Reconnaissance (SCAR)



None of these missions were in the original concept of the B-1



# Revolutionary Tactics



### Success based on marriage of:

- Near-realtime updates with SATCOM
- Teaming with Special Forces
- GPS navigation and weapons delivery
- B-1 inherent capabilities (payload, range, speed & loiter)









# Example



















### On-Call CAS



### Precision weapons gave the capability...

- Integration of High-Res Radar and GFAC Key
  - Can drop on coordinates only; however, non-optimal
- GFAC makes bomber CAS possible
  - Radar talk on by GFAC common



### Key striker during sand storms

Laser-guided weapons unable to target during sand storms/inclement Wx



# **PSYOPS**



## A New Mission using a non-lethal weapon...

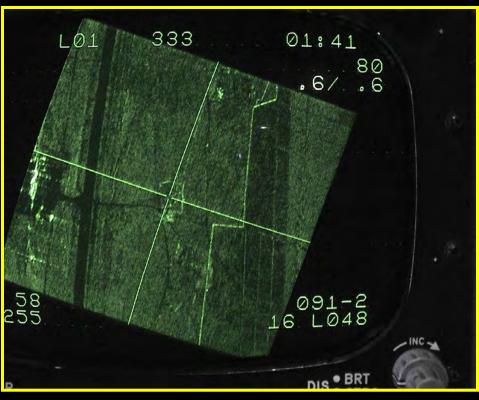










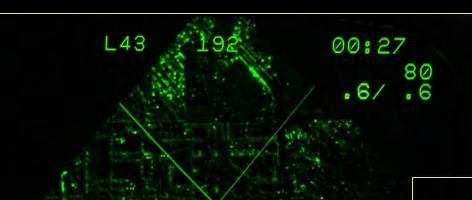




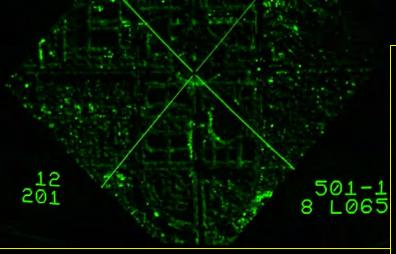
### **Combat Escort**

Afghan President...







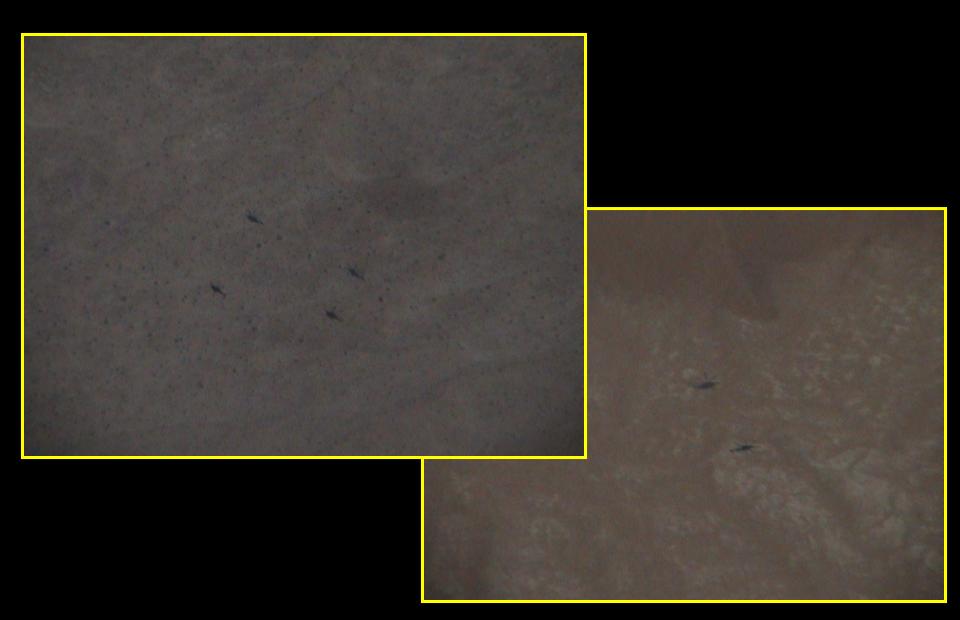






# Combat Escort 22 MEU...







### TST / Emerging Targets



### Leadership, High Value, Strategic Effects...

- Search for SCUD Launchers
- Detect and track suspicious movers
- Support Ground Forces







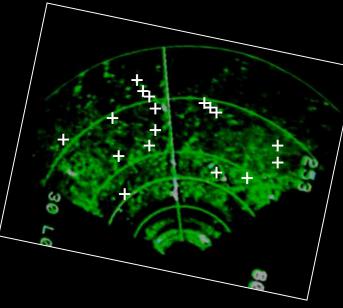
# Strike Coordination and Reconnaissance (SCAR)...



### Scud Hunting

- B-1s assigned 2-hour search patterns
- Ground Moving Target Indicator (GMTI)
  - Detect vehicles moving between 5-75
     MPH
- Monopulse Measurement (MM)
  - Derives coordinates of designated radar return
- Pass vehicle information to another aircraft with PID Capability
- B-1 limited to non-precision strike for moving Tgts (Blk D)
  - Impacted mission weapons load







# Modern Mission Planning







# 7<sup>th</sup> OSS

#### Combat Mission Planning Experts...





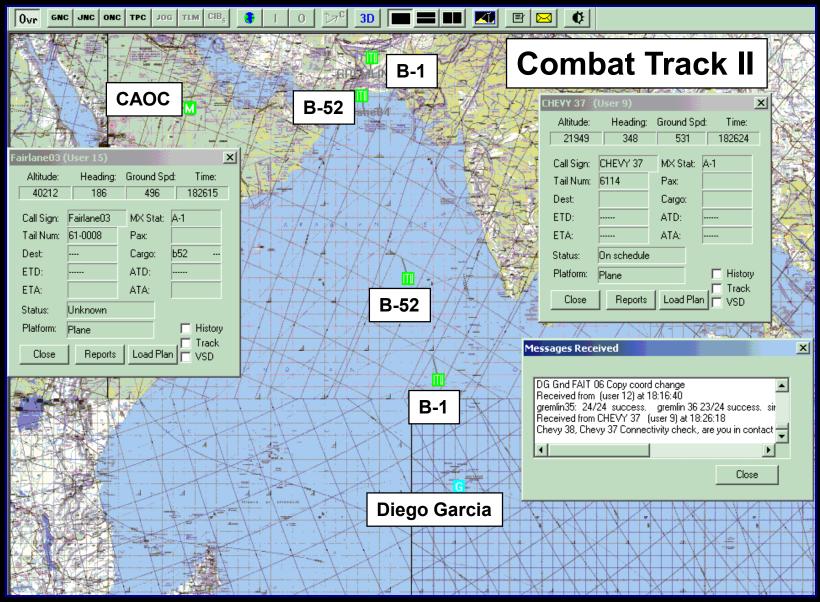






# Modern Mission Planning





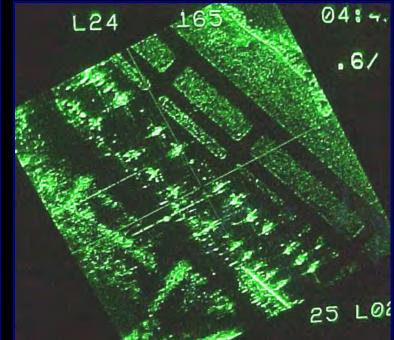


# Modern Mission Planning



AREA TARGET PATTERN MANAGEMENT		
PATTERN SHAPE		DMPI COORDINATES
STAR -	<b>•</b>	N 3139.4065 E06545.4750
COORDINATES		N 3139.3495 E06545.5667
LAT 1: N 31 39.324		N 3139.2573 E06545.5317
LON 1: <b>E 65 45.475</b>		N 3139.2573 E06545.4183
LAT 2:		N 3139.3495 E06545.3833
LON 2:		
ORIENTATION DIST FROM CTR	<b>1</b>	
360 TRUE 500 FT		







# OEF BDA







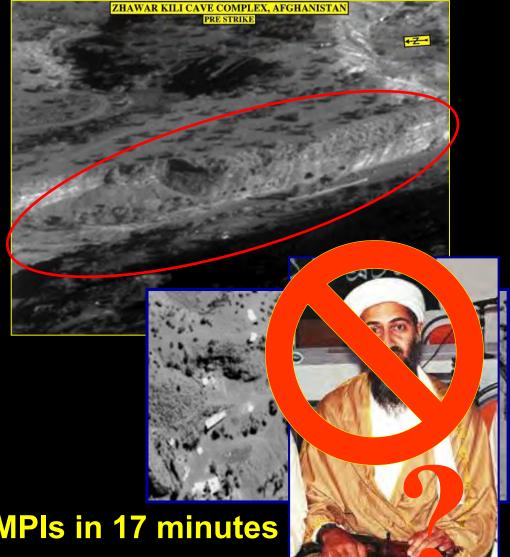






# Zawar Kili Aka "TORA BORA"...

- 3 Jan 02
- Largest PGM strike
  - 4 x B-1 (96 JDAM)
  - 4 x F-18 (8 JDAM)
  - 2 x Predator
  - $-2 \times AC-130$



- Results:
  - -101 GBU-31s on 84 DMPIs in 17 minutes
  - -Cave Complex Completely Destroyed



# Operation ANACONDA



- Delivered 850+ JDAMs
- First-ever B-1B conventional alert; became CENTCOM's top choice for emergency support
- Weapons troops loaded 24 JDAMs in 26 minutesshattering old record of 35 minutes







# OEF BDA



















# Incredible Results







# Incredible Results









# Incredible Results











# OEF BDA



#### We can move Mountains...





# OEF BDA



We can move Mountains...





# Operation IRAQI FREEDOM

















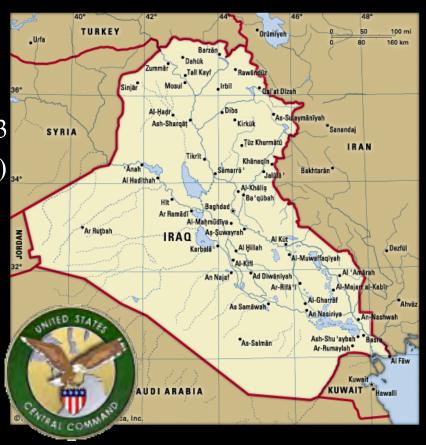
#### Operation IRAQI FREEDOM



19 Mar-18 Apr 2003...

- Over 40,000 sorties flown
  - Total fighter and bomber sorties = 20,703
  - Bombers: 505; B-1: 197 sorties (0.95%)

 All but one mission had changes post step



- B-1 dropped 2,282 munitions
  - 2,214 Iraqi targets; 37 Afghani targets; 24 jettisoned
  - 11% of the total number of guided munitions
  - 43% of the GBU-31 JDAMs (from <1% of the missions!)



#### **OIF Mission**





# • Deployed 10 aircraft to Thumrait AB, Oman

- Flew an average of 8 sorties per day (surge level ops) for duration of deployment
  - First night 10 sorties
- Average sortie duration was 8 hours
- Covered both Iraq and Afghanistan(OEF) missions
- Provided 24-hour/day coverage over Iraq
- Many types of taskings including INT, SAR, XINT, XCAS
- 414 Total B-1 sorties during OIF
  - Includes flights prior to the start of OIF and after 18 Apr



#### **OIF Mission**



Prevent the Iraqi forces from launching any SCUDS into Israel. The President's second highest priority next to eliminating the Iraqi regime.







# OIF Strike Operations



#### Strategic Attack and Interdiction

- Targets were passed from Combined Air Operations Center (CAOC)
  - Passed via secure voice or secure email (Combat Track II)
- Target Array
  - Leadership Targets in Baghdad
  - Airfields
  - Fielded Forces
  - Infrastructure
  - GPS Jamming Towers





## OIF SAFIRES on B-1



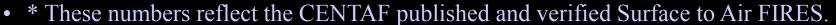
- 71 SAFIRES\*
  - 62 Distant
  - 9 Close proximity (< 2 miles)</li>
  - 35 SAMs
- 35 Launches

- 36 AAA





- 1 SA-6
- 3 Roland
- 4 Unknown SAMs
- 10 Science Projects
  - 8 Ringback,
  - 2 Hookshot
- 8 Unknown Launches



• Aircrews reported more in the MISREPS, but did not meet CENTAF criteria (RJ, Space, etc).



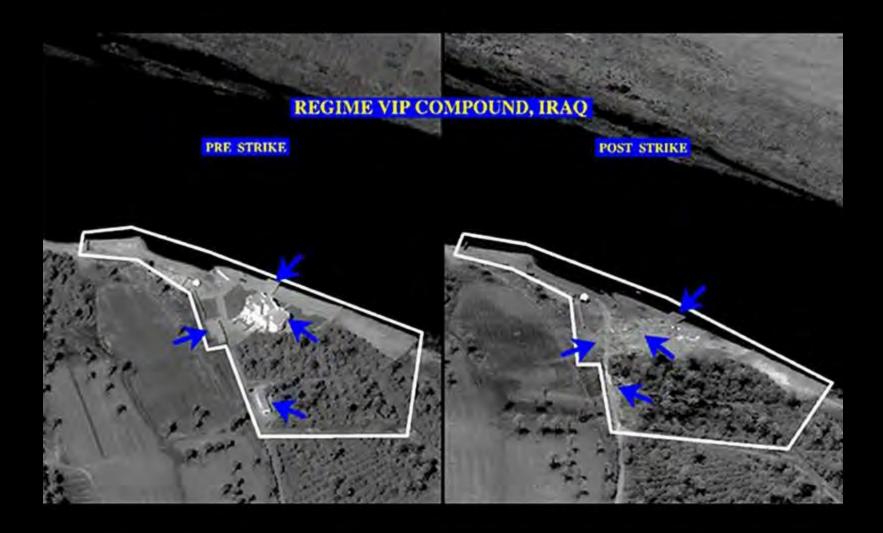






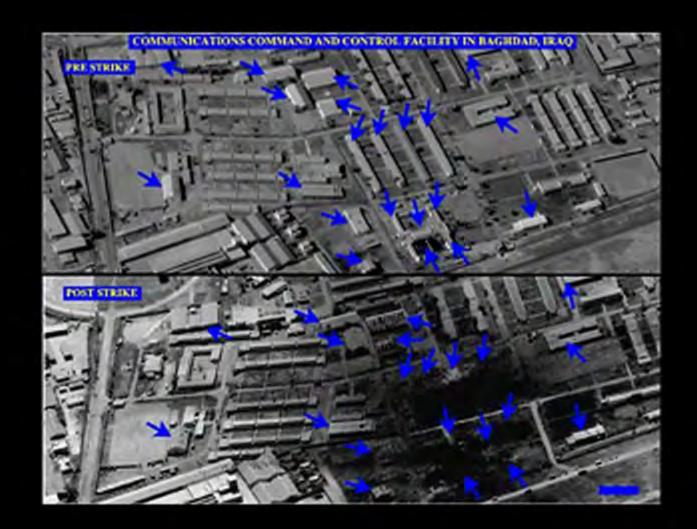




















## B-1 Future: Block E (it's here!)



- Advanced Avionics Computers
- Advanced weapons capabilities
- Wind corrected munitions
  - 30 per B-1
- AGM-154 JSOW
  - 12 per B-1
- *AGM-158 JASSM* 
  - 24 per B-1
- Enhanced situational awareness





#### Main Block E Upgrades



- Cockpit Operations Faster / Streamlined
- Interleaved Search and Track (ILST) Radar Mode
- Multi-bay / Weapon Release Capability
  - GBU-31, WCMD, Mk82, Mk84, CBUs and Mines 2 JDAM 2 WCMD 2 Mk82 (AFT BAY) (MID BAY) (FWD BAY)



# The Block E B-1 in Global Strike



- Single Pass Multi-Weapon Attacks
  - Simultaneously Attack With JDAM / WCMD / Mk82



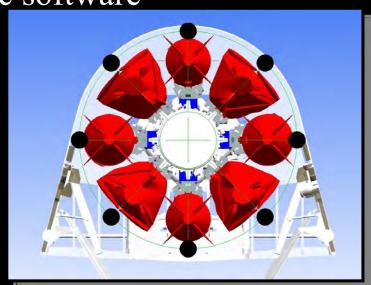


#### **BLOCK "E" ADDITIONS**



MIXED WEAPON LOADS...

- Result of ACC request to assess addition of Mixed Weapon Loads on a rotary launcher within a bay to the Block E JJI release versus waiting 2 4 years for a future sustainment upgrade
- Maximizes weapon load, JDAM & JASSM/JSOW combinations with non-station specific software
- Effort added to contract Jun 03





### Substantial Avionics Upgrade



#### Block D

- Four 70s Era Avionics Computers
- 4 Software Loads Per Mission
- 5 DTUCs (Tape Drives) @\$10,000 Each
- Proprietary Code
- "Optimized" Launch Acceptability Regions (LARs) for Guided Weapons

#### Block E

- Two Pentium Computers
- 1 Software Load Per Mission
- 2 PC Cards @ \$200 Each
- DoD Standard Code (ADA)
- Expanded Launch Acceptability Regions (LARs)

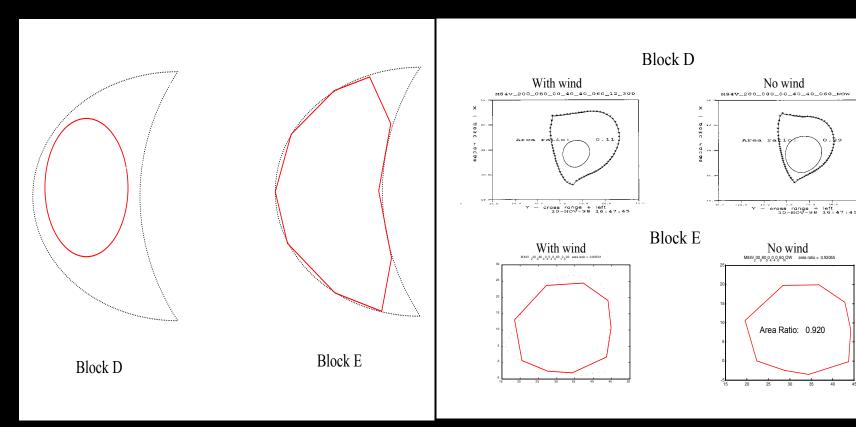
Improved Reliability & Sustainability



#### Improved LARs



- Block D Used Lookup Tables (Tab Data) and Linear Interpolation
- Block E Employs Real-Time Release Conditions and Target Parameters - Far Better in Changing Wind Conditions
- Block E Provides Much Greater Flexibility in Target Area





#### Avionics Improvements



- Increased Situational Awareness
  - Weapon and Navigation Data Improved
  - Digital Bullseye
  - "LAR Bars" ease Guided Munition Prosecution
- "Copy / Paste" DMPIs
- Wind CorrectedMunitions Dispenser(WCMD)



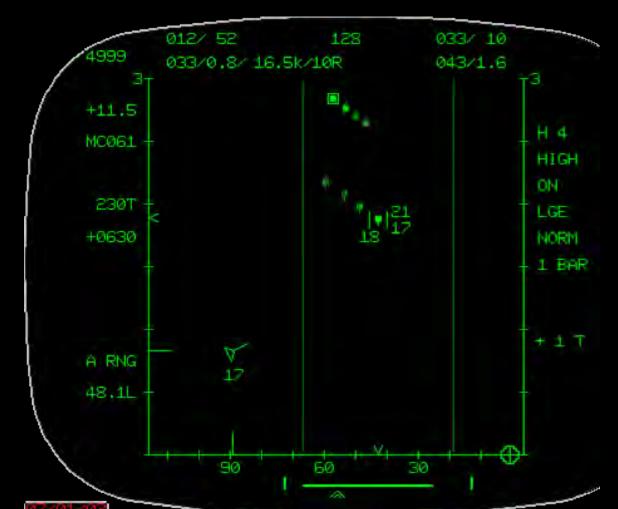


#### Avionics Improvements



*Yes Air-to-Air Rdr...* 

- ILST Essentially the F-16 "SAM" Mode
- Search up to 64 Contacts, Track One
- Tracked Contact Also Updates Threat Situation Display





#### HI-RES UPGRADE



Precision Weapons need precision aiming...



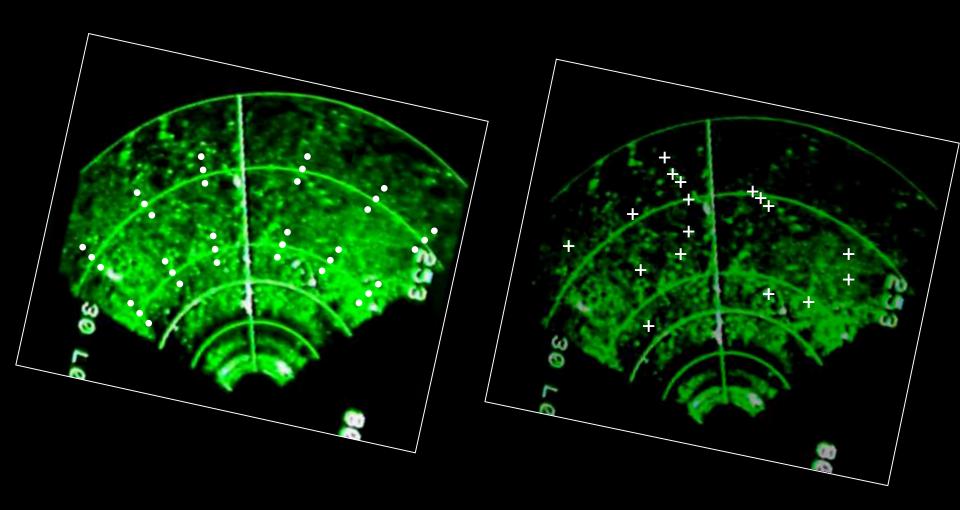


Proposed 1' to .5' Resolution SAR



# **GMTI** Operation





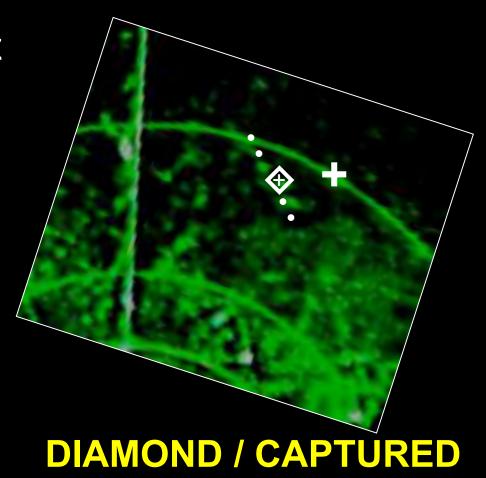
# BUILDING



#### **GMTI** Operation



- Radar tracks moving target and computes weapon impact point
- Large plus displayed around target
- Qual value 0 9
  - 0 < 100'
  - 9 > 900'

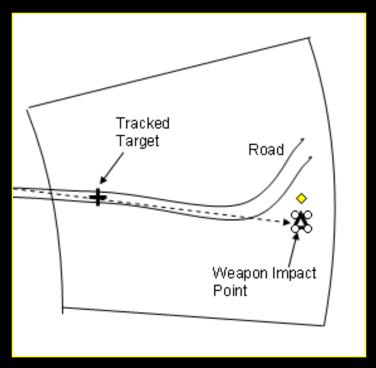


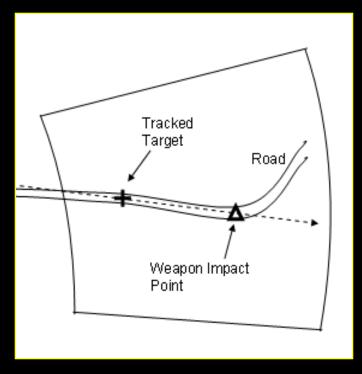


## The B-1 Block E in Global Strike



- Advanced Radar Targeting
  - Automatically Target Stationary or Moving Targets With GBU-31 or WCMD
  - Weapon Stick, Impact Point Displayed on Radar
    - WSO can direct WCMD lay-down axis







### Interim Datalink (IDL)

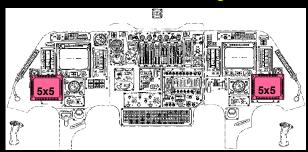


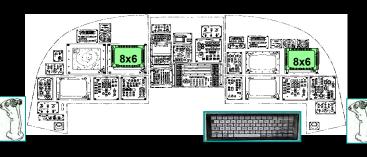
- Adds Link 16 (Line of Sight) and Combat Track II/Airborne Quad Z (Beyond Line of Sight) datalinks
  - Color displays at each crew station
  - Falcon View

• Permanent modification – not integrated with A/C systems except for power, cooling, and A/C position data (1553

data bus)

Modifies 8 jets







## Targeting Pod (SNIPER)



- B-1 Time Sensitive Targeting (TST) experience during OEF / OIF:
  - 95% of B-1 OIF missions re-tasked in-flight
  - Off-board sources required for target Positive Identification (PID)
- EO/IR targeting pod provides autonomous, onboard PID

Pod Status: Future upgrade program



**Current capability (Hi-res radar)** 



Desired capability (EO/IR Pod)



### Block E Weapons

It's a whole new ballgame...



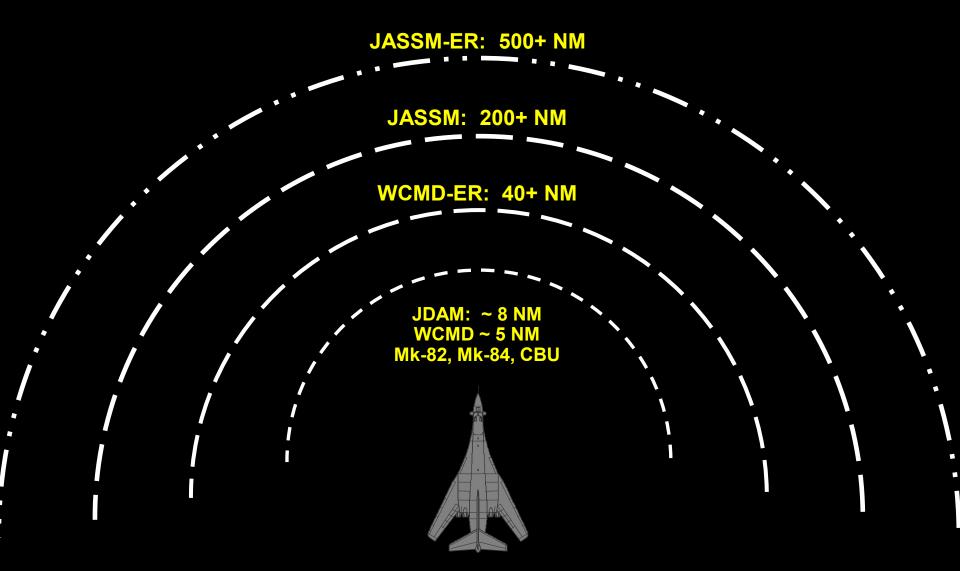


JASSM Capable Now / Crews Fully Trained 3Q 05



## A Range of Options





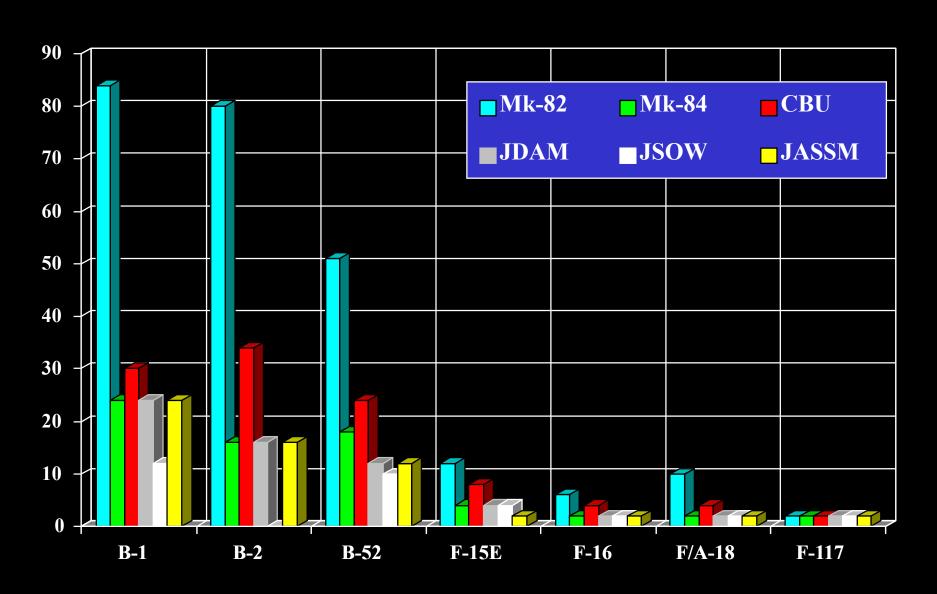
Single Sortie Global Strike Capability



## <u>Comparisons</u>



*To the rest of the Fleet....* 

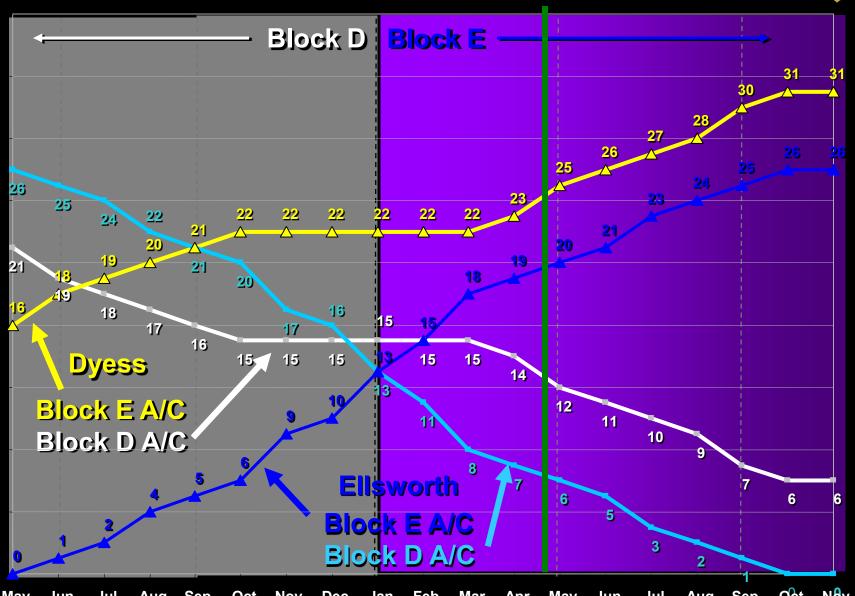




#### **Block E Aircraft Beddown Plan**



(120-day rotations start Sep)





## JOINT AIR-TO-SURFACE STANDOFF MISSILE



(JASSM)



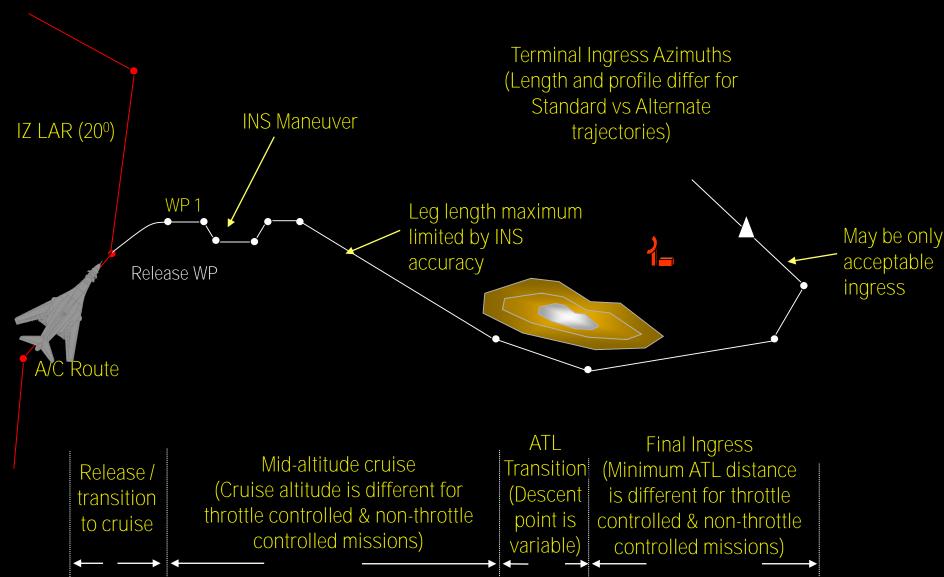
- 24 weapons per B-1
- Use against high-value, heavily defended targets
- Low observable
- Launching aircraft remains outside enemy defenses
- B-1 only MDS to release with no problems

**Precision Stand-Off Capability** 



## JASSM Flight Profile - Top View







# Sensor Fuzed Weapon (SFW)









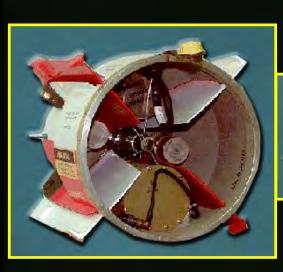
- Wide-Area Cluster Munition
- 40 Projectiles per Bomb

24-Hour, All-Weather, Operational Capability



# WIND-CORRECTED MUNITIONS DISPENSER (WCMD)







- Inertial guidance kit for existing cluster bombs
  - All-weather capability
- Multiple targets in a single pass

**Accuracy at High Altitudes** 



# JOINT STANDOFF WEAPON (JSOW)





- Program terminated in favor of WCMD-ER
- Currently have some 400 weapons
- B-1 will remain capable throughout 2005



# Small Diameter Bomb, WCMD-ER, 500 LB JDAM





16 500 lbs JDAM



30 WCMD-ER



# Design Considerations If you are asking...



- Improved Data Link Capability
  - Post release data link
- Maximize in-flight data/mission modification capability
- Positive Identification Capability
- Long duration issues
  - Power on challenges
  - Captive Carry Issues (training & combat)
  - Sim vs. Real software—minimize differences
- Minimize parameter limitations (speed & Alt)
- Bomber delivery issues
  - Weapon battery duration, CRL/CBM fit, etc.



### OK...That's it

# T S

#### So What's the Bottom Line?

- Block E transforms the B-1 into the Precision Supersonic "Mack Truck"

  "The B-1 was the platform."
  - Explosive leap in capability
- Proven combat platform

"The B-1 was the platform of choice during OEF & OIF!"

Lt Gen Moseley, CFACC

Meets Combatant Commander requirements

"The B-1, probably more than any other weapon system, gives us flexibility on the battlefield that no other airplane would with respect to time sensitive targeting."

Gen Hal Hornburg, ACC/CC



"B-1 bombers...made their presence known in Baghdad, striking the dictator's regime until the regime was no more."

**President Bush** 





















## Questions?







## Contractor / Government Activities



<u>Organization</u>	<u>Location</u>	Role
Prime contractor		
Boeing	Long Beach, CA Oklahoma City, OK Chantilly, VA	Design; Engineering Software Datalink
Major component contractors		
Northrop Grumman	Baltimore, MD	Radar & test facility support
<b>Lockheed-Martin</b>	Owego, NY	Avionics control units
<b>General Electric</b>	Evendale, OH	Engines
<b>EDO</b> Corporation	Long Island, NY	ALQ-161
NLX Corporation	Sterling, VA	Simulators/Trainers
Government field activities		
Aeronautical Sys Center	WPAFB, OH	Program management
Oklahoma City ALC	Tinker AFB, OK	Sustainment, maintenance, repair
AFOTEC	Kirtland AFB, NM	Testing
Warner Robins ALC	Robins AFB, GA	ALQ-161
AFFTC	Edwards AFB, CA	Flight Test
DCMA	Long Beach. CA	OA. Contract administration



#### **BONE's Greatest Hits**

#### **U.S. AIR FORCE**

- Operation DESERT FOX (1998)
  - First combat sorties Mk 82 drops
- Operation ALLIED FORCE (1999)
  - Delivered 2.5 M pounds of Mk 82s
  - ALE-50 decoy "proven performer"
  - First BLOS datalink experience
- Operation ENDURING FREEDOM (starting Oct 2001)
  - JDAM "truck" nearly 4000 delivered
  - Nearly 9 M pounds of weapons delivered
  - Datalink critical in flight replanning emerges
- Operation IRAQI FREEDOM (starting Mar 2003)
  - Primary JDAM platform 2159 dropped
  - Struck 10% of total targets hit
  - Time critical targets continuous, airborne, on-call, precision strike caldatalink now vital to mission
  - In flight planning the norm few "classic" ATO sorties
  - "Strike platform of choice" CAOC Commander











### **Strategy for Future**



#### Keep the B-1 *Lancer* fleet flying — critical

"Sustainment mods

Radar R&M Upgrade

Central Integrated Test System (CITS)

Inertial Navigation System/Gyroscope Stabilization System (INS/GSS)

Vertical Situation Displays (VSD)

In Work Defensive System (ALQ-161)

#### Continue to push B-1 combat capability to the field

GBU-38 – 500 lb JDAM – lower collateral damage

In Work

JASSM-ER — extended-range standoff precision

#### Modernize to address future requirements

Improve aircrew Situational Awareness -- new displays





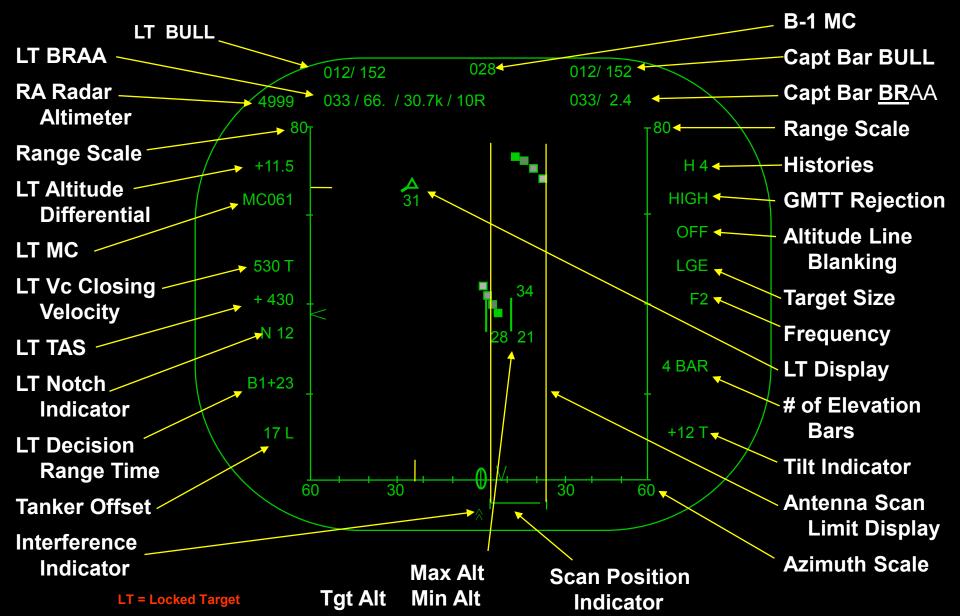




## Block E1 ILST Display

Yes Air-to-Air Rdr...









Imagine if the machines could talk together. That's where we've got to go. ... For the Air Force, go into the Combined Air Operations Center, and see the integration that's going on so we can do things like redirect that B-1 where it needs to be in near real time.

...shortening the timeline from sensor detection to weapons on target, we envision a future where <u>network-centric warfare gives our nation an even greater asymmetric advantage</u> in the war on global terrorism and in future combat operations.

**Gen John P. Jumper, USAF Chief of Staff** 



# Quick Video















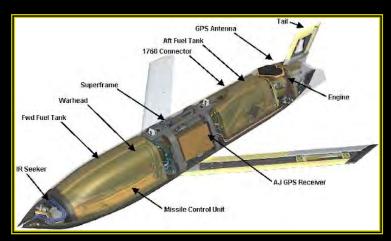




## AGM-158 JASSM



- Joint Air-to-Surface Standoff Missile
  - Long-Range Precision Standoff
  - Weight: 2250 Pounds
    - 1000-Pound Unitary Warhead
  - Length: 14 Feet
  - Guidance: INS / GPS-Aided
  - Range: 200+ NM
- B-1 Carriage: 24
  - 8 JASSM per Bay







## Wesipon Review





JASSM is a CALCM replacement!



## **JASSM Operational Concept**



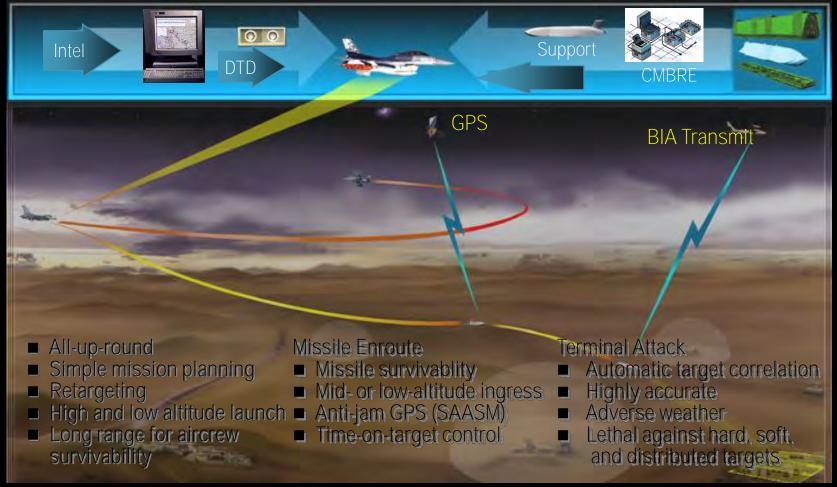
- Mission Development
  Intelligence SupportMissile Route Planning

Loading

- From container
- Existing equipment

**Storage** 

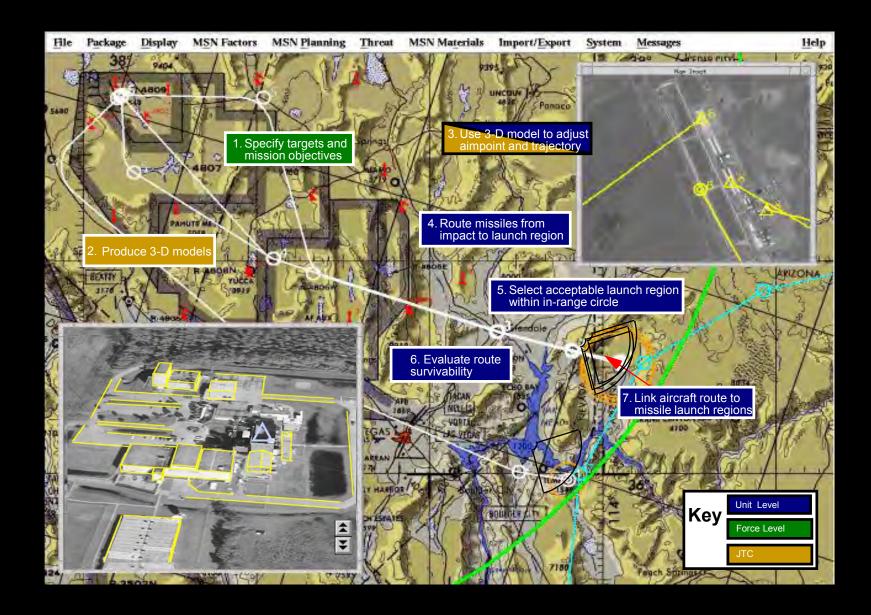
- Wooden round
- In container BIT





## **Mission Development**

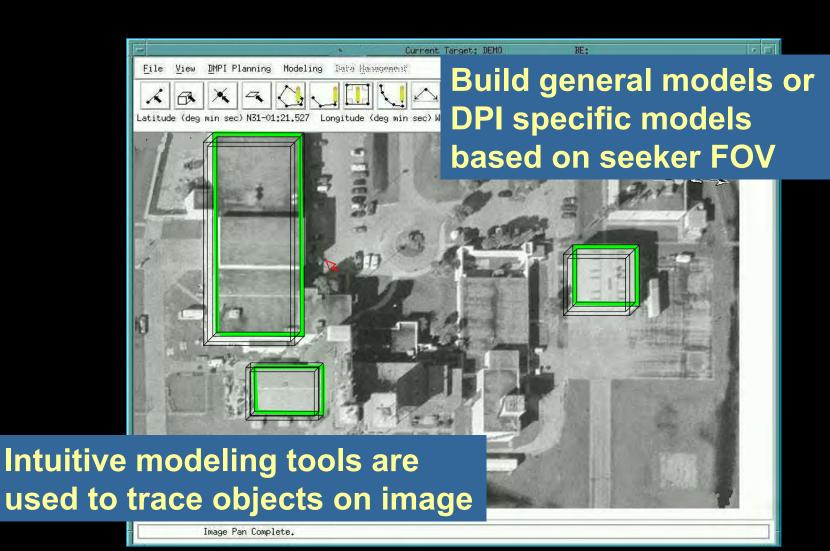






## **Building Target Model**

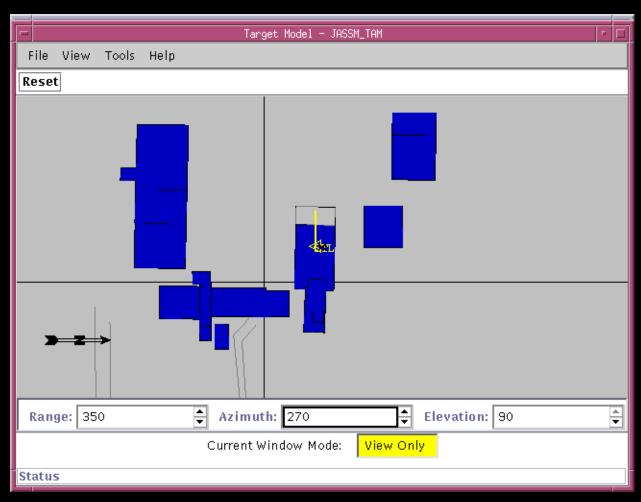






## Viewing Wire Frame From Any Reference Point







#### **Tactical**



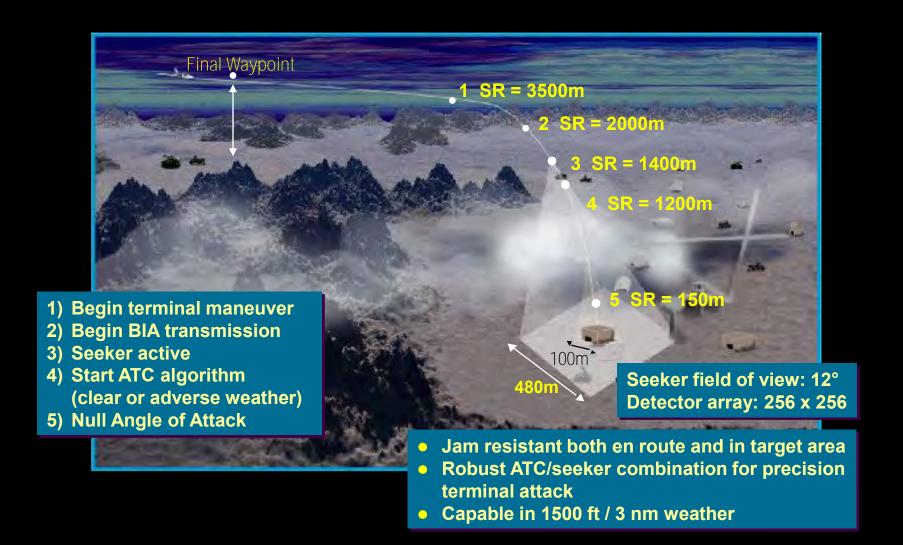
### Close Air Support

- Worked directly with ground forces to strike Iraqi
   Targets within 200m of friendly forces
- Aided Special Operation Forces with capitulating forces
- Key striker during sand storms
  - Laser-guided weapons were unable to target during sand storms and inclement weather



### **JASSM Terminal Attack**







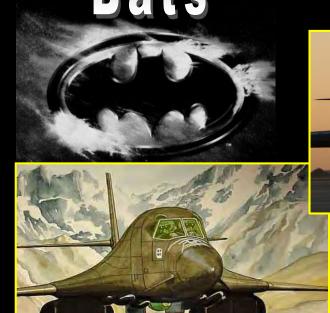
## 9TH EXPEDITIONARY BOMB SQ















- **8 B-1 Aircraft, 200+ personnel and 16 Crews**
- Full range of mission capabilities: Strategic Attack,
   Interdiction and Close Air Support



## **Sustainment Programs**



Wing Shear Bearing



**Cordwood Modules** 

**Intermediate Automatic Test Equipment** 

UNCLASSIFIED

## The Bottom Line

• Precise

• Flexible

Sustainable



#### **B-1** "Good News" Stories



- B-1 CMUP has brought a new era in bomber employment
  - Flexibility -- Precision -- Persistence
  - Single-weapon-per-target capability with JDAM
  - Datalinks critical ... in flight replanning now the norm ... compressed timelines for targeting
- Operation IRAQI FREEDOM success story
  - Flew 1% of total sorties delivered 42% of all JDAMs

CMUP <u>has delivered</u> war-winning capability to the theater commanders



## Summary



- AF Vision for the conventional bomber force established in 1992
- The past decade has seen that vision realized
  - Precision weapons from bomber platforms
  - True Close Air Support missions by heavy bombers
  - Beginning of datalink impacts on air operations

"The B-1, probably more than any other weapon system, gives us flexibility on the battlefield that no other airplane would with respect to time sensitive targeting."



## **Leadership Vision - CSAF**



Imagine if the machines could talk together. That's where we've got to go. We've got to let the concepts of operation lead the way.

... For the Air Force, go into the Combined Air Operations Center, and see the integration that's going on so we can do things like redirect that B-1 where it needs to be in near real time.

... As we experiment with machine-to-machine conversations across the global grid, shortening the timeline from sensor detection to weapons on target, we envision a future where network-centric warfare gives our nation an even greater asymmetric advantage in the war on global terrorism and in future combat operations.

Gen John P. Jumper, USAF Chief of Staff



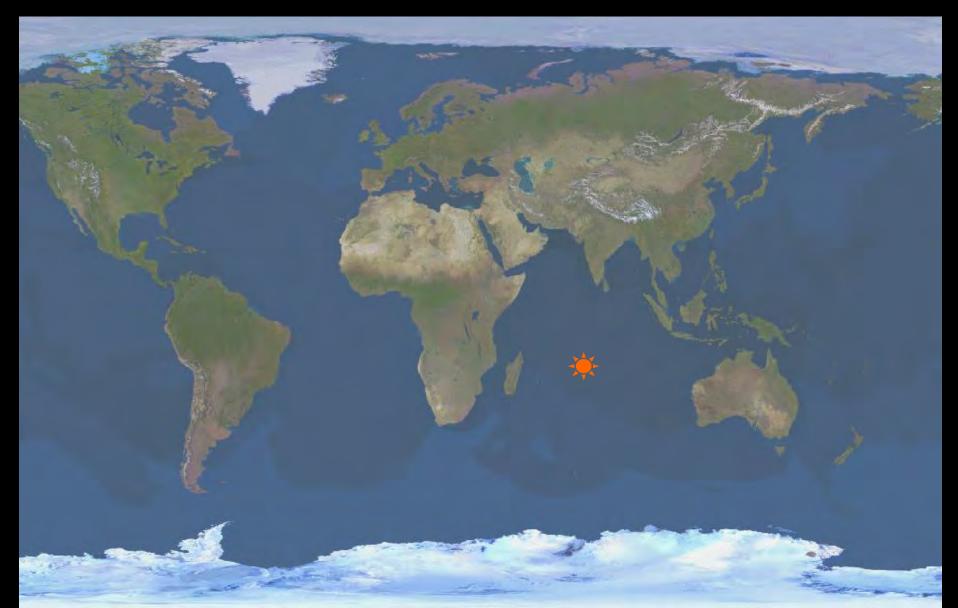




## LOCATION



Ultimate Application of Geography and Politics...





## Fully Integrated Datalink (FIDL)



- Integrates Link 16 and Joint Range Extension (JRE) datalinks with aircraft systems
  - Incorporates expanded J-series messages over IDL
- Upgrades displays at OSO and DSO with color Multifunctional Displays (MFDs) to support display of datalink and weapons management info
- Software upgrades to include addition of automated retargeting capability to take new target data from datalinks and pass to the on-board weapons
- First fields in late CY08



### IDL vs FIDL



- IDL provides basic situational awareness
  - 16 J-series messages total, including:
     PPLI, Air & Ground Surveillance Tracks, Threat Warning, Free Text
- FIDL provides the entire set of messages from Mil Std 6016C applicable to B-1 missions/roles, to include package or mission commander, or support roles to the package or mission commander

- 48 J-series messages total, including:

Electronic Warfare Precise Participant Location & ID (PPLI)

Intelligence Air & Ground Surveillance Tracks

Weather Threat Warning

Control Free Text

Platform & Systems Status Weapons Coordination & Mgt

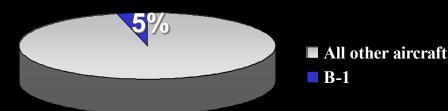
Voice (Objective) Imagery



### The BONE's Contribution



Product of Precision and Payload...



**Sorties Flown** 



35%

**Weapons Dropped** 



**Targets Destroyed** 



"We're not running out of targets, Afghanistan is....."

- Secretary of Defense Rumsfeld









## Operation ENDURING FREEDOM



- Ellsworth deployed 8 aircraft to Diego Garcia, BIOT in 2001
  - Flew an average of 6 sorties per day
  - Average sortie duration of 11-12 hours
  - Initially majority of sorties were INT, then transitioned to more XINT, XCAS



## OEF BONE Community Response...



- 28<sup>th</sup> BW generated 14 fully combat-loaded A/C from across the B-1 community in 5 Days

#### Aircraft/Personnel

- $-4 \times B-1s (28/28/10)$
- $-4 \times B-1s (3 \times CRL)$
- All 8 B-1s
  - Combat Track II (Secure Satellite e-mail)
  - ALE-50 Towed Decoy System
- 16 Aircrews (2.0 crew ratio)









## 28th Bomb Wing

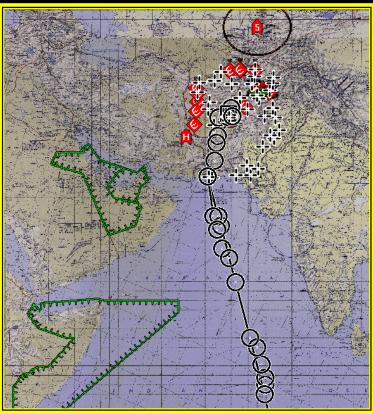


B-1 history Oct-mid Dec 2001...





- Rapid deployment to Diego Garcia
- Combat ops from day #1
- Long sorties with standard profiles and load-outs







## 7th Bomb Wing



Dyess Moves into Action...

- Notified on14 Dec 01
- Deployed 36 hours later
- Stood-up 405<sup>th</sup>
   5 days later
- Moved B-1sfrom Diego1 week later
- Full-up combat ops in 10 days





## 405th Operations Group







### GAS IT, FIND IT, FIX IT AND KILL IT

In one wing, we conducted our own air to air refueling, reconnaissance, intelligence, command and control and strike missions. No other unit in the AOR can do that!



## Operation DESERT FOX





- B-1 Combat Debut
- Iraq forces move south
- 4 B-1s Deploy

4 Days of Strikes in Dec 98



## DESERT FOX



#### HI-RES RADAR DISPLAY...







## Desert Fox B-1 Combat Début...



- USAF/USN Joint Operation
- Dyess & Ellsworth Warfighters
- Targeted Republican Guard barracks





## Operation ALLIED FORCE

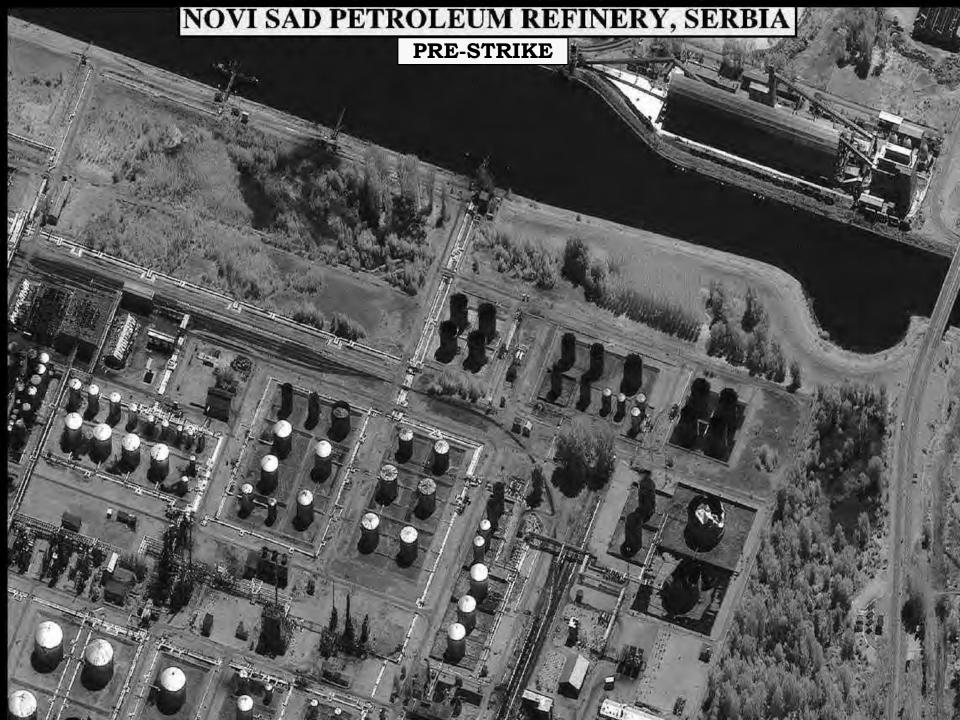




- April June 1999 / Serbia
- 19 Country NATOOperation
- 4 B-1's delivered 20% of all weapons
- Launched first combat sorties within 14 hours of arrival at the forward operating location
- Flew 100 combat sorties and dropped 5,037 weapons amounting to 2,527,570 pounds











### Conclusion

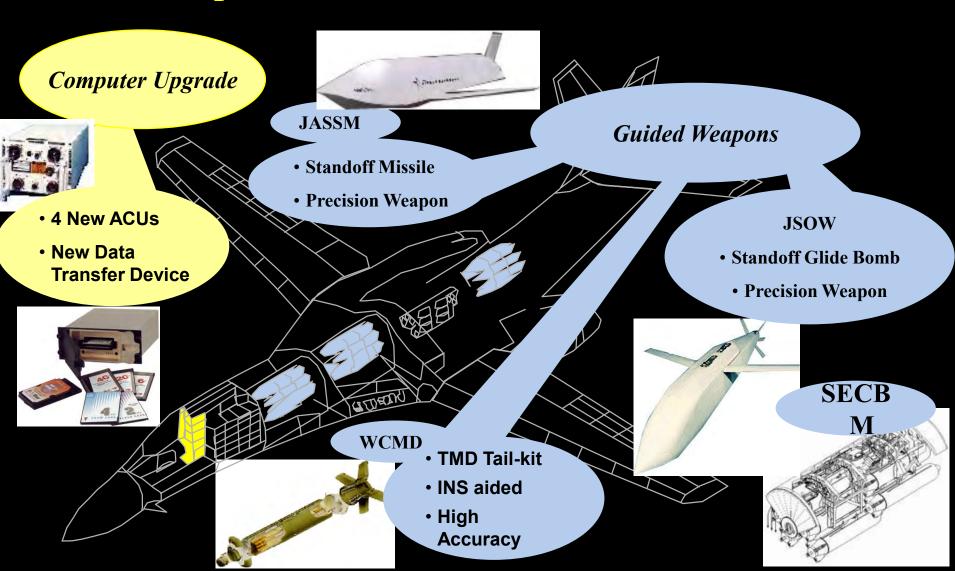


- B-1 played a vital role during OIF
  - Reliable, Flexible, and Lethal
- Proven combat platform
- Combatant Commander requirement



## BLOCK E - Overview Computer/WCMD/JSOW/JASSM/SECBM







#### Situational Awareness

#### Beyond Line of Sight (BLOS) Data Link/Situation Awareness Enhancement (SAE) System

## OEF Combat Mission Need Statements

#### **OIF Success Story**

















## JOINT DIRECT ATTACK MUNITION (JDAM)





- Guidance kit for existing 1,000 & 2,000 lb bombs
- Global positioning & inertial guidance = 10 meter accuracy
- Will be carried on all USAF bombing platforms

**All-Weather, Near-Precision Accuracy** 



## JOINT DIRECT ATTACK MUNITION (JDAM)





- Guidance kit for existing 1,000 & 2,000 lb bombs
- Global positioning & inertial guidance = 10 meter accuracy
- Carried on all USAF bombing platforms

**All-Weather, Near-Precision Accuracy** 



## JOINT DIRECT ATTACK MUNITION (JDAM)



JDAM (BLU-109)

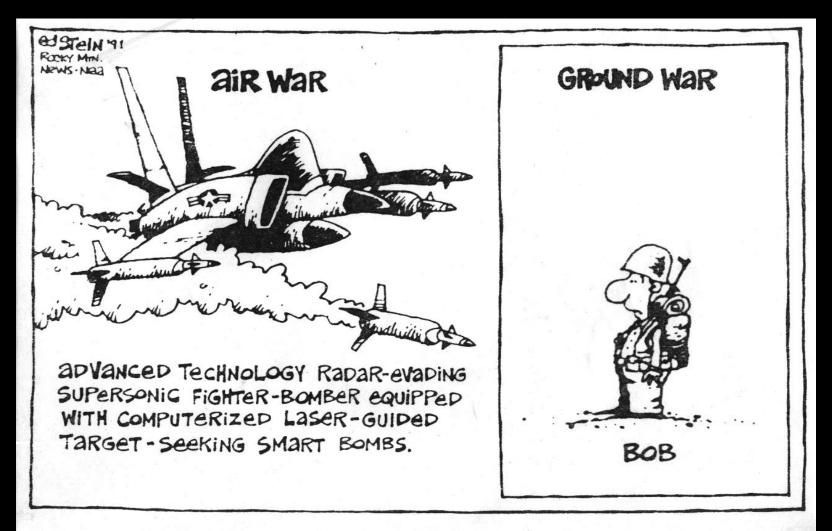
**Accurate, Hard-Target Penetration** 



## The Nature of...



## Airpower





### **Statistics**



- 414 Total B-1 sorties during OIF
  - Includes flights prior to the start of OIF and after 18
     Apr
  - During this time B-1s supported
    - Horn of Africa Operations
    - Operation Southern Watch
    - Operation Enduring Freedom
- 34 EBS
  - 10 B-1s total
  - Averaged 8 sorties per day OSW and OIF
    - First night 10 sorties
    - Average duration = 10.8 hours





19-20 April 2005

EXCALIBUR XM982

**Presented To:** 

Precision Strike Association Annual Programs Review **Presented By:** 

LTC Bill Cole
Product Manager for Excalibur
(973) 724-3152
wecole@pica.army.mil

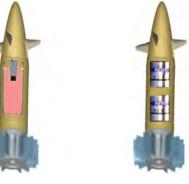
Distribution A. Approved for public release; distribution is Unlimited



### **Excalibur Basics**



- ➤ 155 mm Precision-Guided Extended Range Munition for Cannon Artillery
- Cooperative development
  - ✓ USA and Sweden
- Family of Munitions





UNITARY Block I

















#### **Block I Variants and Requirements**



Block la-1 Initial Capability

Block la-2 Improves on Ia-1 performance; more reliable, capable of higher charge level, tested anti-jam
Block lb Compact guidance section; more capable, more reliable, lower cost, could add SAL seeker

	<u>Unitary Block</u>		
Capability	Block la-1	Block la-2	Block Ib
Delivery Accuracy	10-20m CEP(U)	10-20m CEP(U)* 20-30m CEP(J)	10m CEP(U)* 20m CEP(J)*
Range	30-35 km	39-cal: 30-40 km 52-cal: 50-60 km	39-cal: 35-40 km* 52-cal: 50-60 km
Reliability	> 60%	85+%*	90+%*
Effectiveness	ORD Threshold (M107)	ORD Threshold* (M107)	ORD Threshold* (M107)
Platform & Charge	LW155 (TAD) Paladin MACS 3-4	LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5	LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5

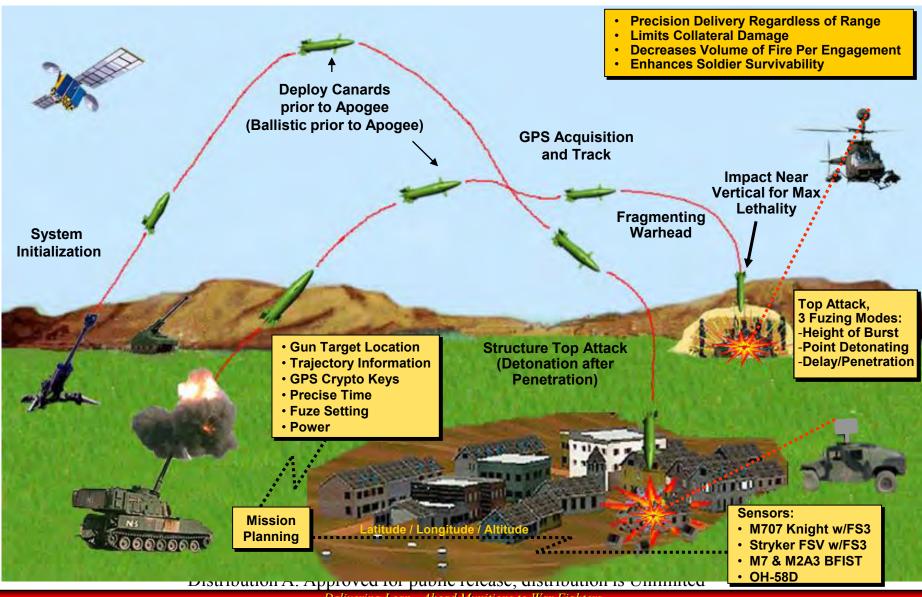
<sup>\*</sup>Denotes KPPs in addition to Interoperability-Top Level IERs. Block Ia-1 has no KPPs.

Distribution A. Approved for public release; distribution is Unlimited



### **Concept of Operations**









# Excalibur Operational Scenario





## **Excalibur Unitary Targets**





#### **Infantry Platoon**

Excalibur: 3 rounds M549: 25 rounds M107: 43 rounds



#### Radar

Excalibur: 1 round M549: 10 rounds

M107: 15 rounds A. Approved for public release; distribution is Unl Mitod:

- ~10m CEP
- Same lethality as an 155 mm HE

Excalibur is used in a complex target environment!

Excalibur at any range M549 at 20Km

M107 at 15Km



#### **Command Post**

Excalibur: 6 rounds M549: 54 rounds M107: 78 rounds



**Structures** 

Excalibur: 3 rounds M549: 147 rounds 1M107: 110 rounds



## Range and Gun Compatibility



- 155 mm, 39 caliber
   Range 30 40 km
- US Amy155 JLWM109A6 PaladinFCS NLOS-C

- 155 mm, 52 caliberRange 50 60 km
- Swedish Army FH77BD



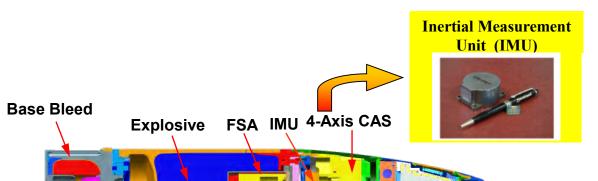


Base

**EPIAFS** 

## **Technical Progress Summary 1**





**GN&C** 

Survived

**Overstress** 

Airgun Test,

✓ IMUs survived tests at MACS-5

✓ Continuing with 2 vendors

√ Honeywell

**✓**BAE



Canard **Actuator System** (CAS)

Payload



17kGs and Gunfire at MACS 4 Canards deployed & guided to target during GG-A

✓ GNU Electronics demonstrated gunhardening gun firing tests (MACS-5)

- ✓ Mission Computer
- ✓ Power Conditioning Unit

**Guidance & Navigation** 

- √GPS Receiver
- ✓ A.J Boards

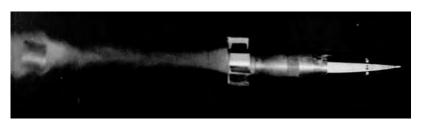
✓ Completing design of **EPIAFS** and Platform

Integration Kit (PIK).
Distribution A. Approved for public release; distribution is Unlimited



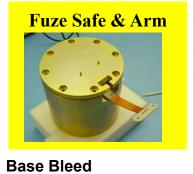
# **Technical Progress Summary 2**



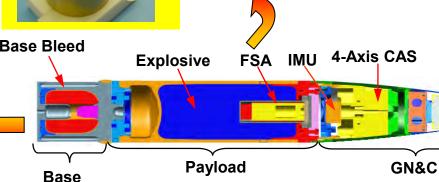




- ✓ MKI.5 Base with Roll Control tested will support upcoming tests
- ✓ Base Bleed tested



- √ Tactical design established
- Second Arming defined
- ✓ Accepted by US & Swedish Fuze boards



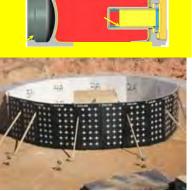
Container

**Base with Fins** 



- ✓ Successful ContainerCritical Design Review; Meets all Requirements
- ✓ Pallet Testing Underway
  Distribution A. Approved for public release; distribution is Unlimited

✓ 1st design iteration arena, penetration and IM tests completed



**Unitary Payload** 



# ACCURACY: Demonstrated at Guided Gunfire A Test Series



#### Range to target: 20 Kilometers

#### **Objectives**

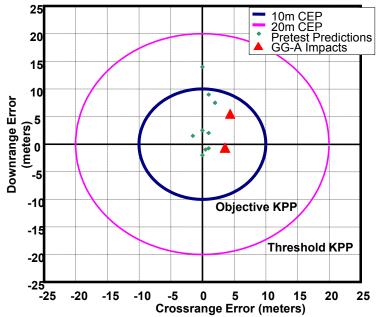
Demonstrate that projectile de-rolls when commanded, correctly orients, acquires GPS, calculates a navigation solution and guides a non-ballistic trajectory to a point on the ground

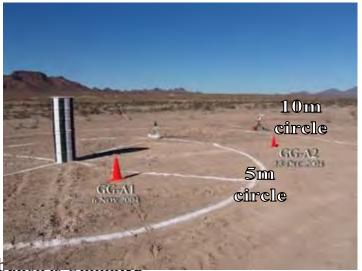
#### Configuration

- > 3 Projectiles fired at MACS-4 charge from LW155 & Paladin cannons
  - Guidance & Navigation Unit (GNU)
    - · Tactical computer & flight software
    - · C/A Code (civilian) GPS
  - Tactical Canard Actuator System (CAS)
  - Encrypted Telemetry System (in place of tactical HE warhead)

#### **Results**

- ✓ All objectives successfully met; 2 of 3 rounds impacted in target area
  - ✓ Demonstrated Accuracy: 3.4m & 6.9m
  - Full Functionality of Guidance and Navigation System
  - ✓ Guided to Programmed Target Location
  - Performed Terminal Tip over Maneuver over Target
  - o Projectile #2 flew ballistic
    - Shortcoming of GPS C/A code caused large change in navigation solution; round went into fail-safe mode
    - All future guidance tests will use military Y-code GPS which will not have this problem







## **Guided Gunfire A Test**



GG-A

Shot #3

18 Dec 2004





## **Major Upcoming Test Events**



- Lethality Demo June
  - ✓ First Guided Flight with HE Warhead
- Guided Gunfire B
  - Demonstrate initialization, projectile flight performance and Fuse Mode functionality
  - ✓ Various ranges and charges
  - Exposure to environmental conditioning
- Sequential Environmental Tests Safety
  - Extreme environmental conditioning
  - ✓ Loose cargo and drop testing
  - ✓ Fired at charges up to PIMP+5%



# Support to the Warfighter



- Commanders in the CENTCOM AOR want a capability for cannon fired precision munition
  - ✓ Immediately responsive precision fires
  - Munition with limited collateral damage
- The Army Staff has asked PM Excalibur to accelerate testing and fielding
- Value to Warfighter
  - ✓ Allows destruction of high-payoff targets in urban & complex terrain
  - Minimizes collateral damage
  - ✓ Reduces risk to friendly forces in close fight
  - ✓ Responsive; organic to UA Brigade
  - ✓ All weather capability
  - ✓ Fly to grid capability; no laser required



# **Questions?**





# Capabilities Based Planning: An AT&L Perspective on FCB Interactions



Mr. James "Raleigh" Durham OUSD(AT&L) Defense Systems



- □ Capabilities-Based Planning (CPB)
  - ➤ New Joint Capability Areas
  - ➤ Notional Mapping to Current Capability Areas
  - ➤ DoD End-to-End Process (old and new)
- ☐ Force Application Activities under CPB
- □ AT&L Perspective



# Capabilities Based Planning (CBP) Objectives

CBP should be a top-down, competitive approach to weigh options vs. resource constraints across a spectrum of challenges

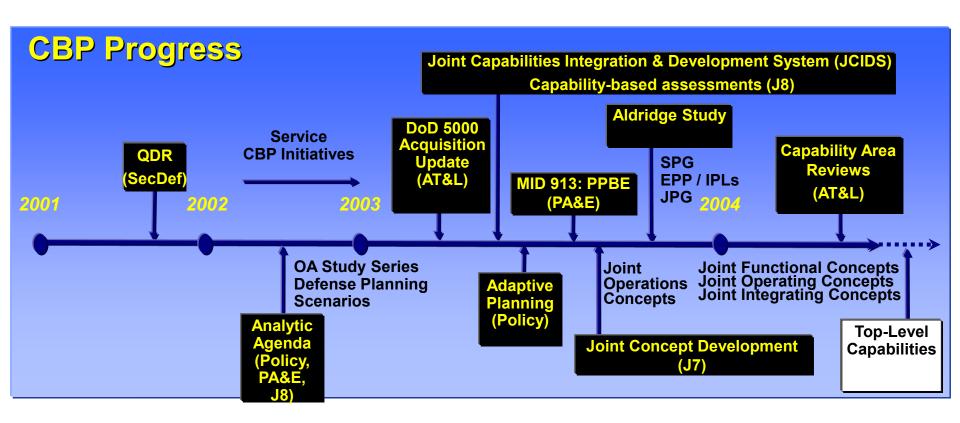
#### **CBP** should:

- □ Link DoD decision-making to the Defense Strategy
  - > Encompass the full set of DoD challenges
- Inform risk tradespace -- identify joint capability gaps, redundancies and opportunities
  - ➤ Generate common framework for capability trades
  - Couple programmatic capability development to operational needs
- Facilitate the development of affordable capability portfolios



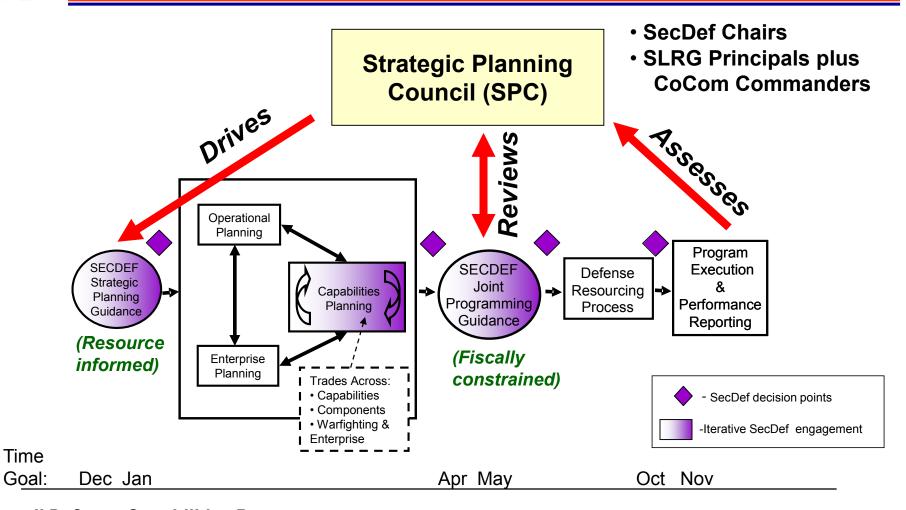
# New Capabilities-Based Processes

□ PPBS, the last major change in DoD resource management (1960s), was based on a decade of prior analytical development





### **CBP Top-Down Process**

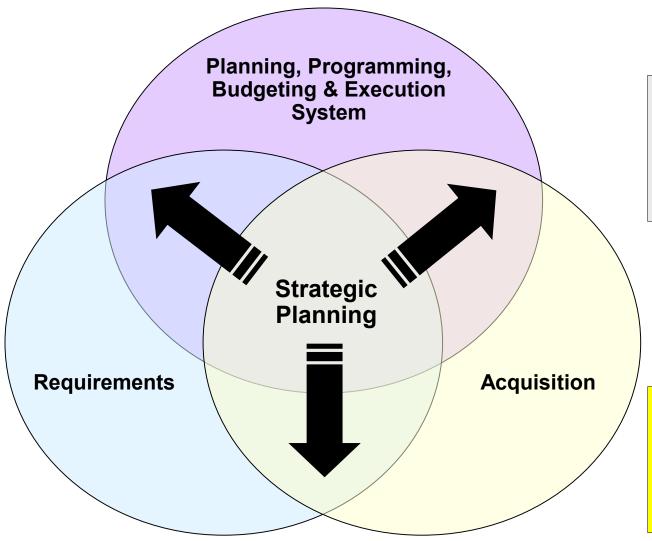


#### **Overall Defense Capabilities Process:**

- Senior Leadership Upfront
- Department-Level View of What's Needed
- Linking Strategy to Planning to Programming



# CBP Integrates Across Processes



CBP integrates major
DoD processes to
facilitate strategic
planning

CBP is enabled through a common set of joint capability definitions



# DJCS(J-8) CBP Process

**Defense Planning Scenarios** 



DoD Planning Construct and Stretch Goals

Irregular	Catastrophic
Traditional	Disruptive

OSD Policy Strategy



DJCS (J-8) *Macro* 

Warfighting Capabilities and Corresponding Force Structure



Operational Availability Assessments

JCIDS
For materiel and
Non-materiel
solutions

Functional Capability Boards *Micro* 

Joint Integrating Concepts

Capabilities Based Assessments

Capabilities Gaps and Overlaps



# Proposed Definition Set: Joint Capability Areas (Tier 1)

- Battlespace Awareness
- Command and Control
- Network Operations
- Interagency Coordination
- Public Affairs Operations
- Information Operations
- Protection
- Logistics
- Force Generation
- Force Management

- Homeland Defense
- Strategic Deterrence
- Shaping & Security Cooperation
- Stability Operations
- Civil Support
- Non-Traditional Operations
- Access & Access Denial Operations
- Land Control Operations
- Maritime/Littoral Control Operations
- Air Control Operations
- Space Control Operations

<u>Developing a common lexicon</u>



# Notional Mapping of Joint Capability Areas to Current Joint Operating Concepts

#### **Homeland Security**

Homeland Defense Civil Support

#### **Strategic Deterrence**

Strategic Deterrence
Shaping & Security Cooperation

#### **Stability Operations**

**Stability Operations** 

#### **Major Combat Operations**

Access & Access Denial Operations

Space Control Operations

Air Control Operations

Maritime/Littoral Control Operations

**Land Control Operations** 

**Non-Traditional Operations** 

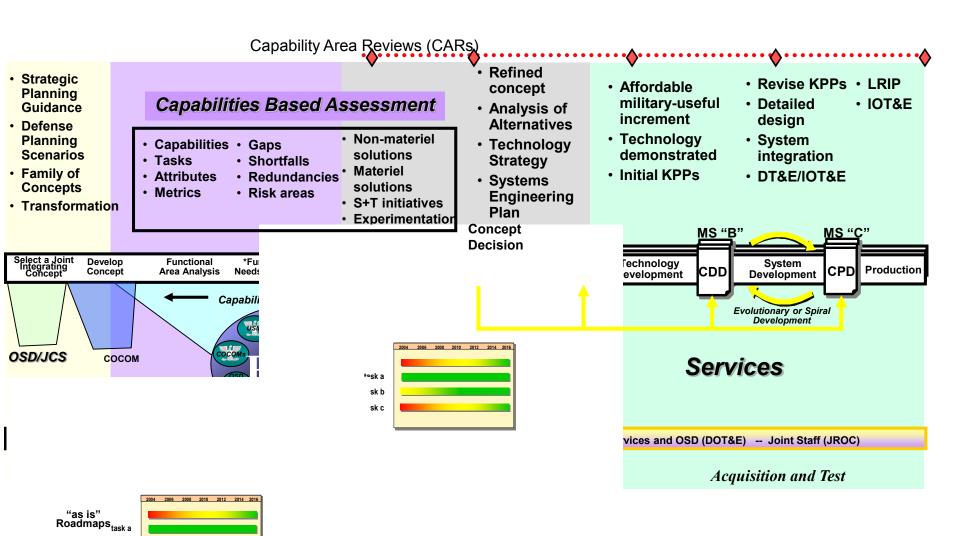
**Information Operations** 

**Stability Operations** 



task b

## **DoD End-to-End CBP Process**



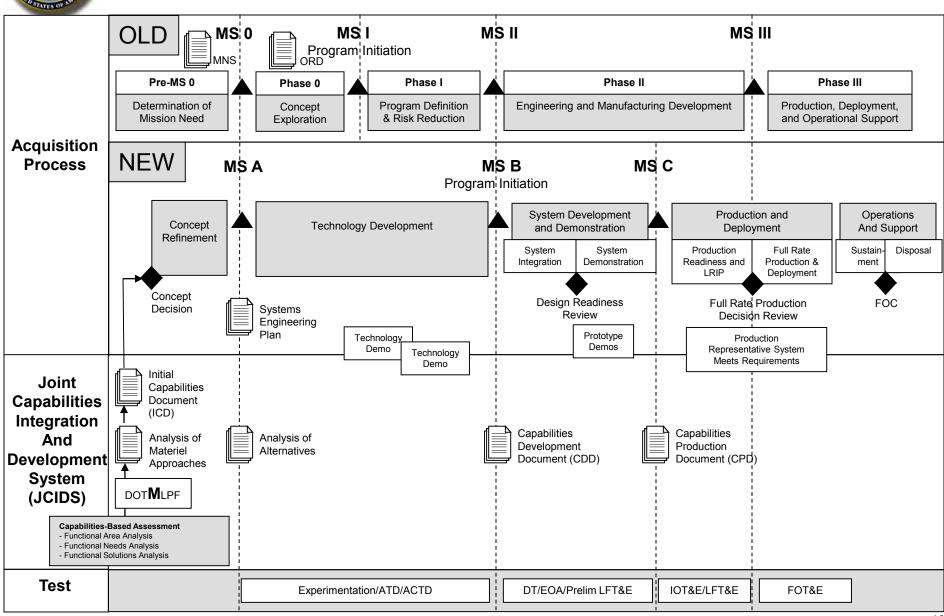


# Capabilities-Based Planning: Perspective from AT&L

- Acquisition has traditionally focused at the program level
- ☐ Under CBP, acquisition will widen its perspective
  - ➤ Infuse technology and programmatic reality into planning and decisions
  - ➤ Shape, engineer, and validate solutions to capability needs
  - Make decisions on systems within a capabilities context (systems perspective)
  - ➤ Engineer the relationships across the set of systems that together satisfy the need (systems of systems)
  - Synchronize the interaction among programs to satisfy multiple capabilities (roadmaps)
  - Provide a coherent logistics transformation strategy supporting distributed, adaptive operations



## **Process Overlays**





# The FCBs -- "Hot, Sweaty Pile"

#### AT&L participates and advises Capabilities-Based Assessment FAA FNA **FSA Joint Integrating Concept** -Capabilities -Non-materiel -Gaps **Development** -Tasks -Shortfalls **Alternatives** Missions -Attributes -Redundancy Materiel Capabilities –Metrics -Risk Areas **Alternatives** Tasks -S&T Initiatives DPS-based vignettes -Experimentation Army Navy USM PONSOR COCOMs Air Force COCOM OSD DIA or AT&L Service OSD OSD NII PA&E **FCB Co lead** - OSD SES



## Current ATL (DS/SMI/JFA) FCB Activities

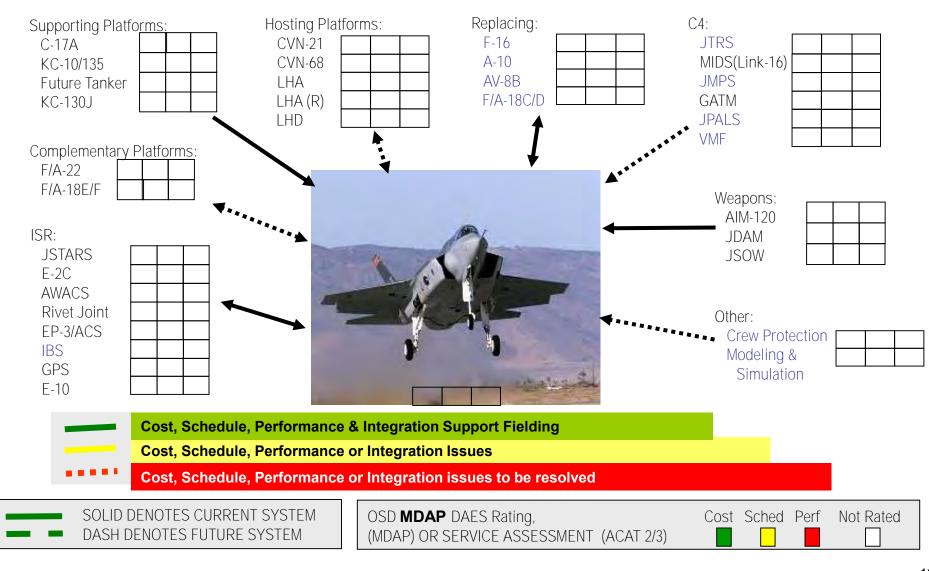
- □ JCIDS Capabilities Based Assessments
  - Joint Undersea Superiority
  - ➤ Joint Forcible Entry Operations
  - ➤ Global Strike
  - ➤ Integrated Air and Missile Defense
- □ AT&L-led Capability Area Reviews and Roadmaps
  - Previous: Integrated Air and Missile Defense; Conventional Engagement Capability (Land Attack Weapons)
  - ➤ Future: Electronic Warfare; JBMC2
- □ Studies
  - ➤ Medium Range Bomber/Long Range Strike; Emerging Technologies for TACAIR; Aviation Capabilities; Cross-Capability Assessment and Risk Management Framework for Evaluating Major DoD Force Capability Options



- ☐ Study of JCIDS/5000 Transition
  - ➤ Examining the transition ("lead change") from requirements to acquisition; key point of intersection is the FSA through AoA.
  - Highlight success criteria, roles and responsibilities for critical decision points
- ☐ Study of Capability Area Reviews
  - > Examining the structure and content of CARs
  - ➤ Identify key focus areas, process requirements, and analysis requirements
- □ DAB-level System "In context" Reviews
  - ➤ Expands the scope of individual program DAB reviews to include critical interrelationships between supported and supporting programs and systems within the capability / mission area
    - Example on next slide



# Example: JSF Interrelationships with Complementary Systems





# Current Issue: Family-of-Systems System Engineering

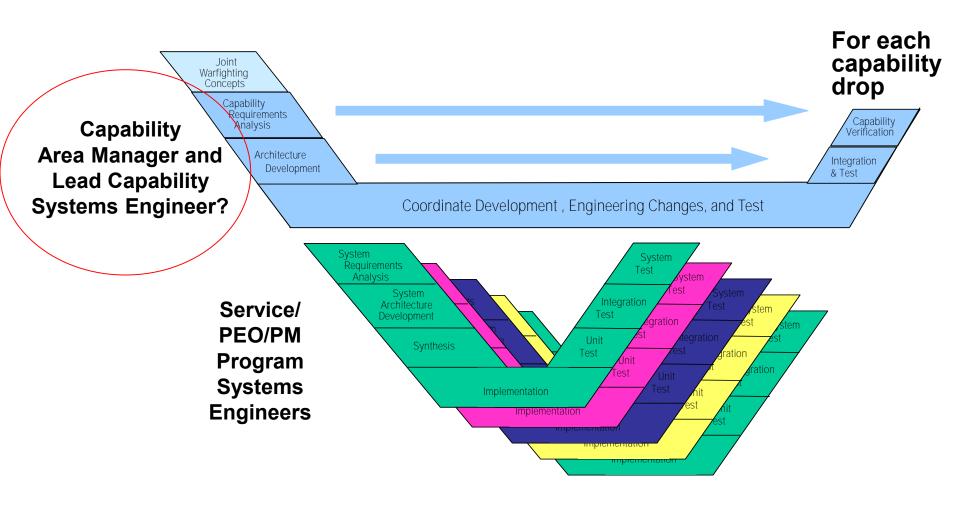
- Problem Statement (IAMD CAR DAB):
  - Certain capabilities only appear in a Family of Systems context.
  - How do these FOS capabilities get engineered within the various individual systems
  - How do these FOS capabilities get tested
- Example
  - Capabilities such as Combat Identification must be implemented in numerous systems across all Services and Agencies to enable the joint warfighter to use that capability in combat

**CLASSIFICATION** 



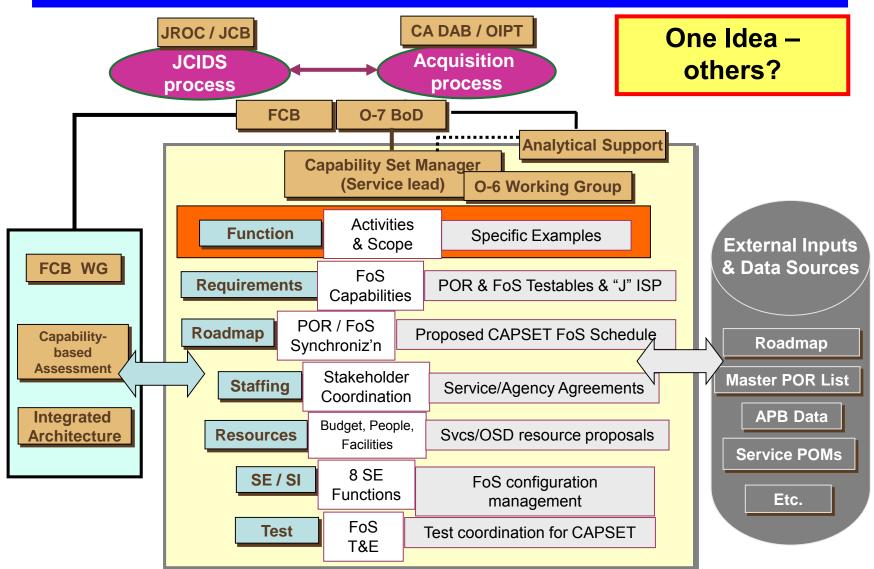
## SE at a Capability Level\*

How do we do this?





# Building a FOS Capability – One View

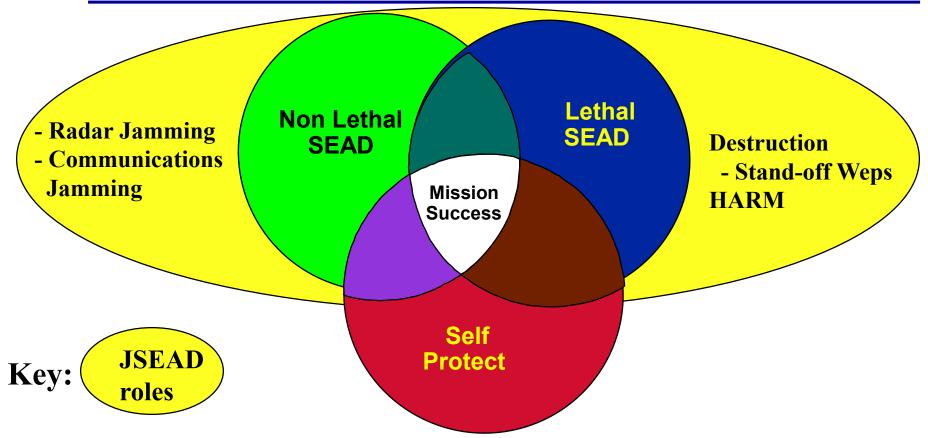




# Example: Capabilities Based Acquisition Applied to JSEAD



## JSEAD and Aircraft Survivability



Deny, Delay Radar Acquisition/Tracking/Lock-On

- Radar Cross Section design
- On Board Radio Frequency/Infrared Countermeasures
- Off Board Countermeasures
- -- Towed Decoys/Chaff/Flares

SEAD capability interacts with Self Protection - synergistic effect



## Service Response to AEA AoA: AEA System of Systems Concept

#### Stand-In Core **AEA AoA Recommendation** Component Component **High Flyer Mod-Escort Complete Capability** Sensing capability to support reactive jamming Full frequency coverage Mod-Escort Stand-In Specialized high power jamming\* Stand-in jamming **SAM Range** Stand-off Mod Escort Penetrating Escort Stand-In

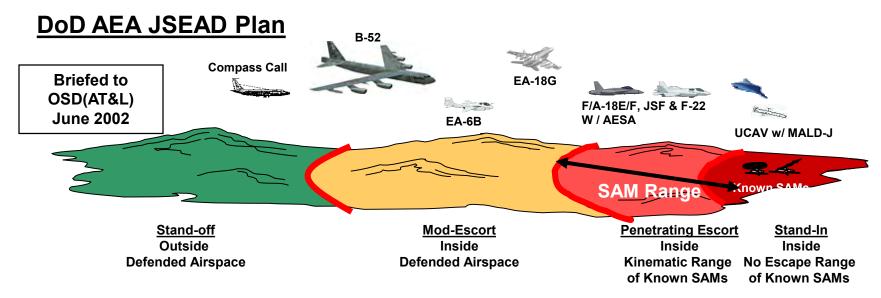
\*AESA Radars, Advanced Waveforms, and High Power New Technology AEA Arrays collectively can provide Specialized High Power Jamming Capabilities.

**Outside Defended Airspace** 

Outside Known SAM Rings

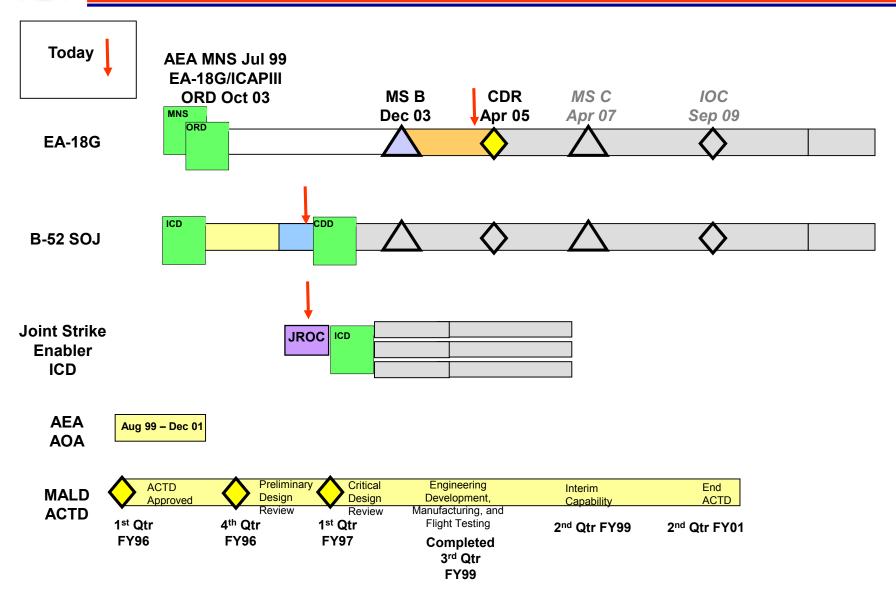
Within Known SAM Rings

Within SAM No Escape Zone



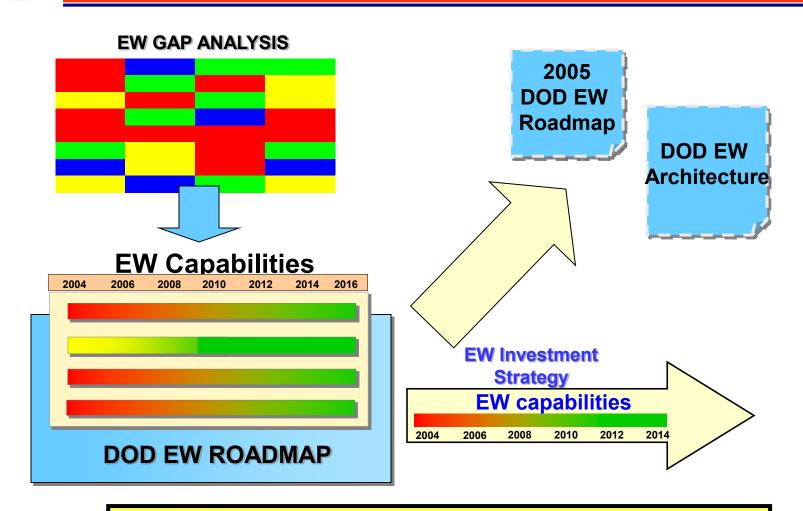


# Where Are They Now...Sample AEA/SEAD Programs





# Electronic Warfare (EW) Capabilities Analyses and EW Roadmap



Objectives: Document a Joint EW Vision; Develop an EW Roadmap and Investment Strategy



# Requirements-to-Acquisition: Some AT&L Observations

- Capabilities-Based Assessments help inform decision makers not a decision-making tool in and of themselves
  - > Still rely on Services to identify and attempt to resolve shortfalls
- ☐ JCIDS is still evolving potential to impact acquisition
  - Joint Capability Areas, Streamlining JCIDS are latest initiatives
  - Sufficient data/analysis to support decisions?
- ☐ Process is still oriented towards Service-developed ICDs
  - Services are beginning to develop "joint" ICDs together (e.g., JSE)
- Need for process flexibility is recognized
  - Program migration from old to new acquisition framework (e.g., MNS/ORDs to ICDs/CDDs, MS I to MS A)
  - Application of single-program criteria to Family-of-Systems programs (e.g., Future Combat System)



# Requirements-to-Acquisition: Some AT&L Observations

- ☐ Early involvement of AT&L is a plus
  - Allows for greatest leverage in preventing mistakes / misconceptions and understanding Service objectives
  - Engaging with subject matter experts (e.g., acquisition policy) can do a lot to avoid unnecessary delays
  - PA&E is our most useful partner in this phase
- □ NII is an increasingly important ally as programs attempt to translate the Net Ready KPP into an actual capability



# Questions?



Know the Earth...Show the Way

## InnoVision Future Warfare Systems Office

Laying the Geospatial-Intelligence Foundation for Future Warfare

# Brief to Precision Strike Program Review

Jon D. Estridge Chief, Air Warfare/Targeting Division NGA Future Warfare Systems (IW) InnoVision Directorate



What is NGA and What Do We Do?

Our vision...

## Know the Earth...Show the Way

...D/NGA as the functional manager for GEOINT:

Department Of Defense Directive Number 5105.60 (dated 11 October 1996)

...Providing **GEOINT** in all its forms, and from whatever source imagery and geospatial— to **ensure** the **knowledge foundation** for planning, decision, and action.



...Affording **easy access** to GEOINT data, for <u>all</u> stakeholders.

...Creating tailored, customerspecific GEOINT; providing analytic services and solutions; and sharing insight.

## Our Contribution to National Security

Geospatial Intelligence provides the knowledge basis for decision,

planning, and action

## <u>Geospatial</u> <u>Intelligence: Who are</u> <u>its customers?</u>

- National policymakers
- Combatant commanders
- Homeland Security agencies
- Intelligence Community analysts
- Military
   Departments
   (Services) - Title 10





#### What is NGA and What Do We Do?

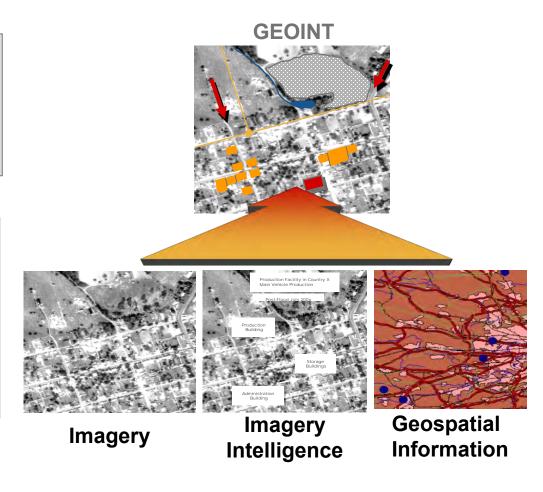
## National Geospatial-Intelligence Agency (NGA) is a National Intelligence and Combat Support Agency

#### Mission:

Provide Timely, Relevant, and Accurate GEOINT in support of National Security

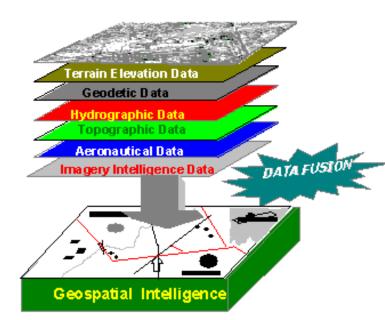
#### **Definition:**

GEOINT is earth-referenced information about natural and man-made objects or events with National Security implications



## Geospatial Intelligence (GEOINT)

 A 4-D framework of information for comprehending objects and events, planning and executing operations, and assessing effects



- How are the enemy's physical and virtual infrastructures constructed?...
- How do they interrelate and operate?...
- What are my COA options and COEs?...
- Where am I?...
- Where are the Friendlies?... Hostiles?...
   Non-Combatants?...
- How do I move or navigate in the battlespace?...
- What is the environment?...

## **GEOINT Provides the Basic Foundation** for Effects-Based Operations

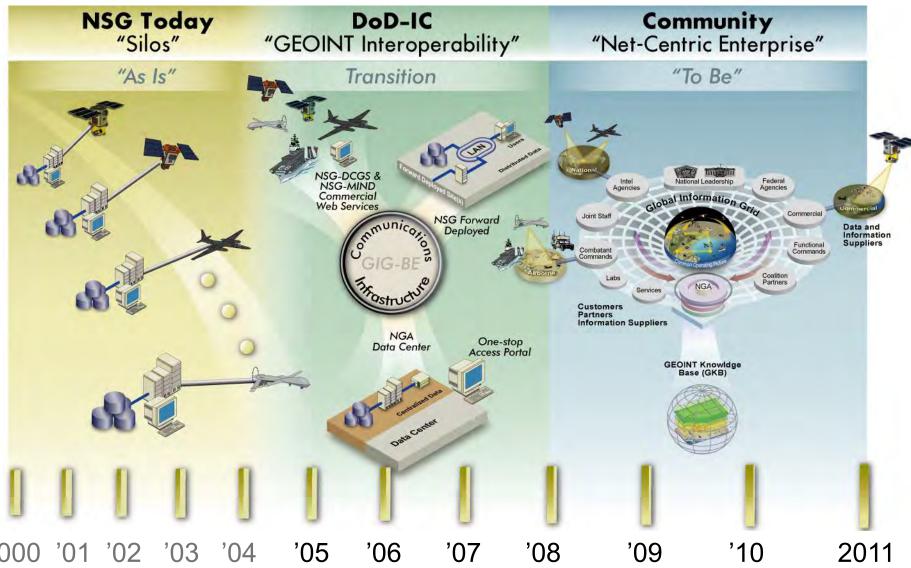
## Key Elements of NGA Transformation

- All-digital Operating Environment transition from a paper-centric to a layered, data-rich network-centric environment accessed via single portal
- Foundation Data –Specific information on essential features that change rarely or slowly (i.e., point positioning data, topographic features, elevation data, safety of navigation)



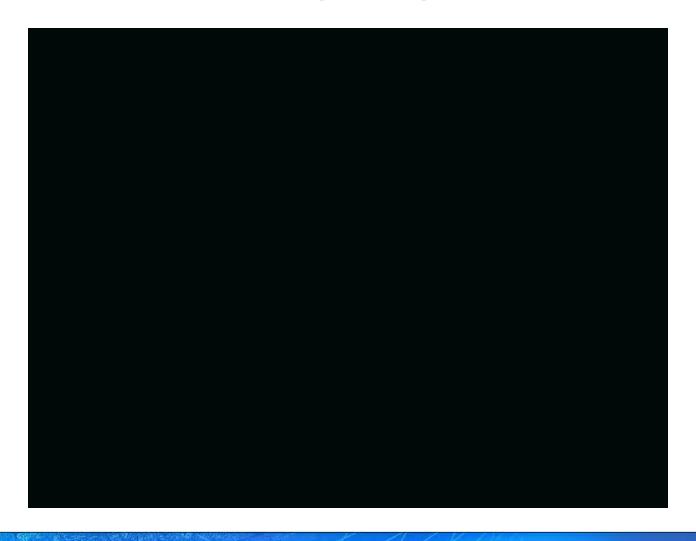
- Mission Specific Data –Intensified Foundation Data encompassing greater detail or additional features and/or attributes to meet specific mission requirements
- Geospatial-Intelligence Knowledge Base (GKB) –NGA data environment composed of two content layers: foundation layer and intelligence layer (weather, order of battle, intelligence reports, features, multi-intelligence, elevation)

## ▶ The Transition



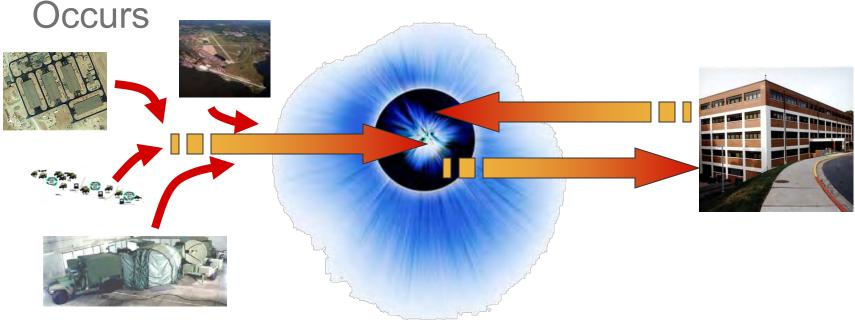


# Geospatial Intelligence Knowledge Base (GKB)



## Customer Self-Serve Portal

- Provides Stakeholders with One-Stop Access to All of NGA's Holdings
- Means Through which Web-Based Collaboration



## ► The Changing Challenge....

## Above Surface



12 - 24 Hours



Moving

Hours

0 - 4 Hours



#### Denial and Deception



**Traditional NTM Coverage** 

## Below Surface

Characterized





**Uncharacterized** 



### A short picture history of the impact of GEOINT

1943

1970

1991

2005

2010



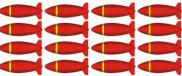


















1500 B-17 sorties 9000 x 250 lb. bombs One 60' x 100' target W.W. II 30 F- 4 sorties 176 x 500 lb. bombs One Target Vietnam

1 F-117 sortie
2 x 2000 lb. bombs
Two Targets per Sortie
Desert Storm

1 B-2 sortie
16 x 2000 lb. bombs
16 Targets per Pass
Available Today

1 FA-22 sortie
8 x Small Diameter
Bombs
Future Weapon Attacks
Mobile Targets









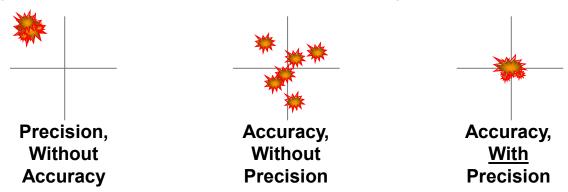




1

## Weapon Performance: Precision & Accuracy

It's always a matter of precision <u>AND</u> accuracy:



- Both matter if you're shooting a weapon at a coordinate!
  - Latitude: 350342.791NPrecision
  - Longitude: 1072256.017E
  - Height above Ellipsoid: 529.38m
- In and of themselves, PGMs <u>are not</u> inherently any more accurate than any other type of weapon; but, their behaviors <u>are</u> more predictable and controllable
- The focus must be on our ability to achieve a delivery accuracy commensurate with our ability to achieve precision trajectory control

Future Warfare Systems Office



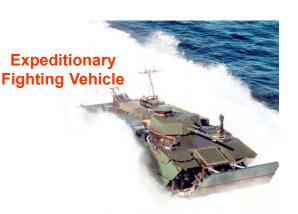
Future Warfare Systems Office (IW)

## **Mission**

- Identify and meet DoD and Military Service needs for Geospatial Intelligence for emerging and future warfare systems to ensure their desired effectiveness
- When necessary, facilitate technical, operational, or programmatic solutions to eliminate shortfalls

## The Idea

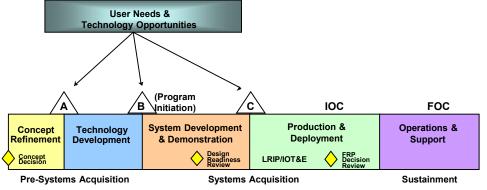
- Introduced by General Clapper
  - Warfare systems of the future will increasingly depend on the information provided by NGA
  - NGA must be part of the process and fully engaged from the inception of acquisition programs
  - GEOINT cannot be an afterthought





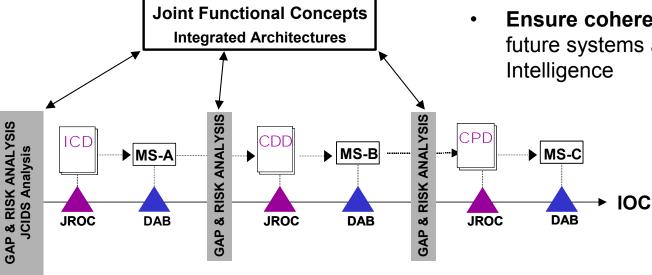


## NGA's Focus on Future Warfare Systems



**Strategic Policy Guidance** 

- Interface early in acquisition cycle
- Participate as a special member to the DAB
  - Attend IIPTs, OIPTs
- Ensure NGA understands specific Geospatial Intelligence needs of future warfare systems
- Ensure Warfare Community understands NGA's planned capabilities
- Ensure coherence between Services' future systems and NGA's Geospatial Intelligence



## ▶ Goals . . . and Benefits

#### NGA/IW's Goals

- Understand Future Warfare System GEOINT Needs
- Educate Warfare System Stakeholders on NGA's Transformation Goals and Initiatives
- Identify GEOINT Support "Disconnects" Early in Warfare System's Development
- Inform NGA transformation

## Potential Benefits – for Warfare Programs and NGA

- Lower technical and cost risk
  - For future MDAP systems
  - For the National System for Geospatial-Intelligence (NSG)
- Increased NGA Responsiveness
  - Optimized Warfare System Performance
- Better Informed Budget Priorities and Decisions
- Better Technology Investments
- More Focused NGA Transformation

#### :

## IW Program Alignment

#### **OSD Liaisons**

USD(I) USD(AT&L) Scott Robertson, A. Director

John Powers, A. Deputy Amy Wandless, BX Randy Anders, A. TX

**Key Programs** and Initiatives

#### AIR/SPACE/TGT

-F/A-22 & F-35

-JUCAS

-SDB

-AOC

-JMPS

-AMD

-PAC 3/MEADS

- CV-22

#### LAND/SpecOps

-FCS

-EFV

-NLOS

-Soldier System

-PRV

-Complex Terrain

-Special Ops Support

-Rotary Wing A/C

#### **NAVAL**

-LCS

-DD (X)

-JHSV

-ASDS

-ERGM

-VXX

-MMA

-ASW ConOps

#### C4ISR

-ACS

-JBMC2

-DJC2

-DCGS

-WIN-T

-JTRS

-JLENS

## Air Warfare Future Systems

## • F/A-22, F-35 (Joint Strike Fighter)

- Next generation fighter aircraft
- Extremely robust radar and sensor suite (direct targeting)
- JSF developing "digital cockpit" with leap ahead technologies
- Non Traditional ISR IW authored early draft CONOPS, adopted by Air Combat Command (ACC) as baseline for USAF document
- Early program spirals focused on air worthiness



## Challenges

- JSF cockpit moving map (Defining digital map support)
- Ensure JMPS integrated with future GEOINT
- Limited on board space for NGA support data, partnering with programs to develop registration/data storage to support targeting
  - Unknown requirement for fidelity of high resolution elevation data, ongoing testing with Level II DTED (SRTM) and DPPDB
- F/A-22 SAR standards
- Accessing NTISR data to make available via National System for Geospatial Intelligence (NSG)



## Future Munitions

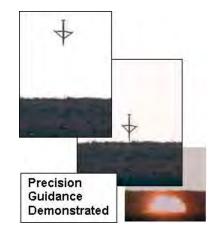
### Small Diameter Bomb (SDB)

- First in family of miniature munitions
- Minimize collateral damage, engage multiple targets per sortie
- DPPDB is source of precise coordinates (accuracy)
- NGA teaming with OSD DOT&E to support live tests
- USAF submitted SDB accuracy requirement Apr 05

### Challenges

- Maintain or improve accuracy, currency, and coverage of DPPDB holdings supporting GPS/INS seeking wpns
  - Ensure programs understand capability & limitations
- Target characterization (4m wpn vs 20m knowledge)
  - GEOINT foundation for target system analysis
- Teaming with USAF to define future accuracy reqt







## Takeaways

- GEOINT is critical to effectiveness of future DoD warfare systems
  - Targeting, navigation, mission planning, situational awareness
- NGA is committed to fully supporting Future Warfare Systems!
- Must continue to engage early in process
  - JCIDS (FCB), IIPTs, Service Labs, etc.
- Encouraging specified vs implied requirements
  - DRAFT JP 3312.01









## NGA Organization

NGA Organization

Director **Deputy Director STAFF Offices Executives** Western **Military** Technical **Business** LINE Directorates Analysis and *InnoVision* Source **Enterprise** Acquisition **Operations Operations Production** NEXT NEXT W

**ENABLER Directorates** 

Human Development

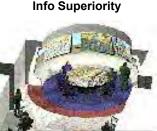
Financial Management Security & Installations

## **Supporting Transformation**

- **DoD's and NGA's Transformations: Our Mutual Objectives** 
  - Our Nation's military is transforming how it fights new threats, new capabilities, and new operational concepts
  - Those changes are driving NGA to change
  - We understand where the Department is going and are transforming to meet our Geospatial Intelligence needs
- Discovering and understanding the needs of and future warfare systems is a full time job
  - **Evolving systems' needs for geospatial intelligence are** substantial and require DoD-wide scrutiny
  - NNGA's role in supporting defense acquisition
- The process is costly and requires:
  - Close cooperation among Commands, Services, and **Agencies**
  - Recognition that this is a DoD-wide interest









**Aerospace Superiority** 



Precision Engagement

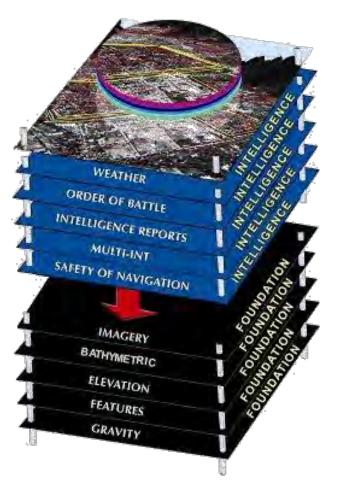


Agile Combat Support



## What is GEOINT and Why is it Important?

Definition: Information about any object - natural or man-made - that can be observed or referenced to the earth, and has national security implications

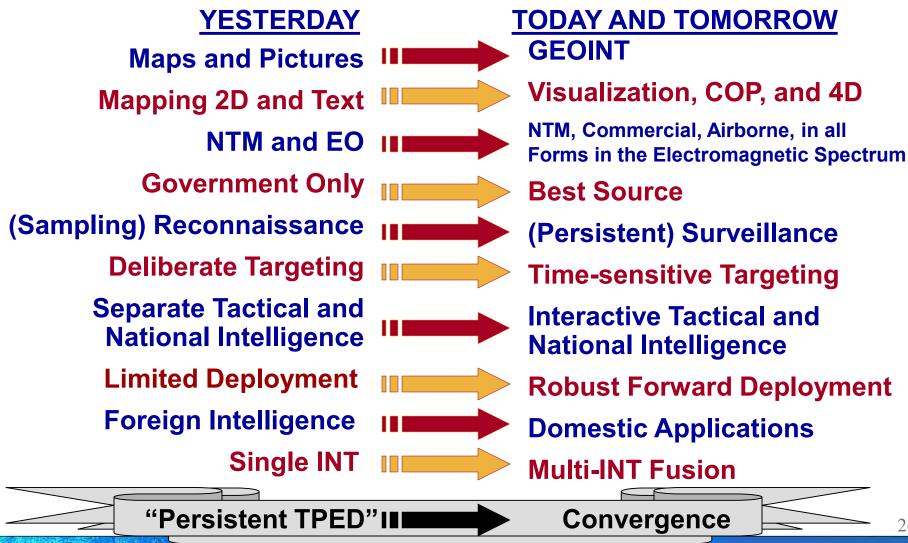


- Where am I?
- Where are the Friendlies?
- Where are the Enemies?
- Where are the Non-Combatants?
- How do I move or navigate among them?
- What is the Environment?
- What does it mean?
- What is the impact?



How is NGA Transforming?

### **Trends transforming NGA**





## JASSM Topics

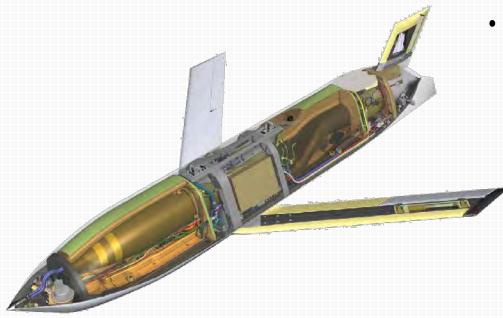


- Program Overview
- JASSM Capability Of Today
- JASSM Capability Of The Future
  - JASSM Extended Range (JASSM ER)
  - Electronic Safe and Arm (ESAF)
  - Weapons Data Link (WDL)
  - Maritime Interdiction

## What Is JASSM?



• A joint Air Force and Navy Program to provide an <u>autonomous</u>, <u>long range</u>, <u>conventional</u>, <u>air-to-ground</u>, <u>precision missile</u> able to strike highly defended, high value targets



- It fills an urgent requirement for a system that will:
  - Cost less than \$400K (FY95\$) AUPP objective
  - Take out enemy command and control
  - Survive the advanced threat environment
  - Attack the target autonomously
  - Reduce risk to aircrew
  - Operate in adverse weather
  - Launch from both fighters and bombers
  - Reduce mission planning timelines

## System Requirements



#### **Targets**

- Air defense sites
- Hardened bunkers
- Large reinforced buildings
- Distributed soft targets
- Bridges
- Other (small hard targets)



#### **Carrier Operable**

- Insensitive munitions
- Shipboard handling
- CATS & TRAPS
- Naval environment
- Compatible with "yellow gear"



## System Performance Specification

- >200 NM Range
- Missile mission **Approximately** effectiveness 1 missile/target

±5s

- Time-on-target
- Off-axis release 180 dea
- In-flight GPS Retargeting



#### **Mission Planning**

- AFMSS (MPS and JMPS)
- Uses existing intelligence infrastructure
- < 5 min per route plan</li>
- < 15 min per target UNCLASSIFIED





Platform/Loadout

- 12
- 16 24
- F/A-18E/F
- 3



#### Supportable

- Complete 15-year warranty
- Wooden round
- Uses existing support equipment
- In-container built-in test
- Load from container
- Stack up to 5 high

## Concept of Operation

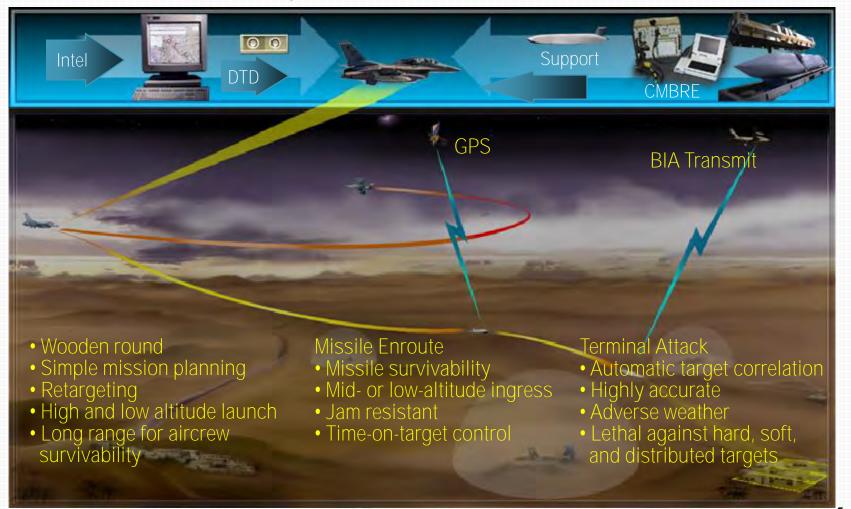
- Mission PlanningRear area planningForward area planning

#### Loading

- From container
- Existing equipment

#### Storage

- Wooden round
- In container BIT



## JASSM Topics

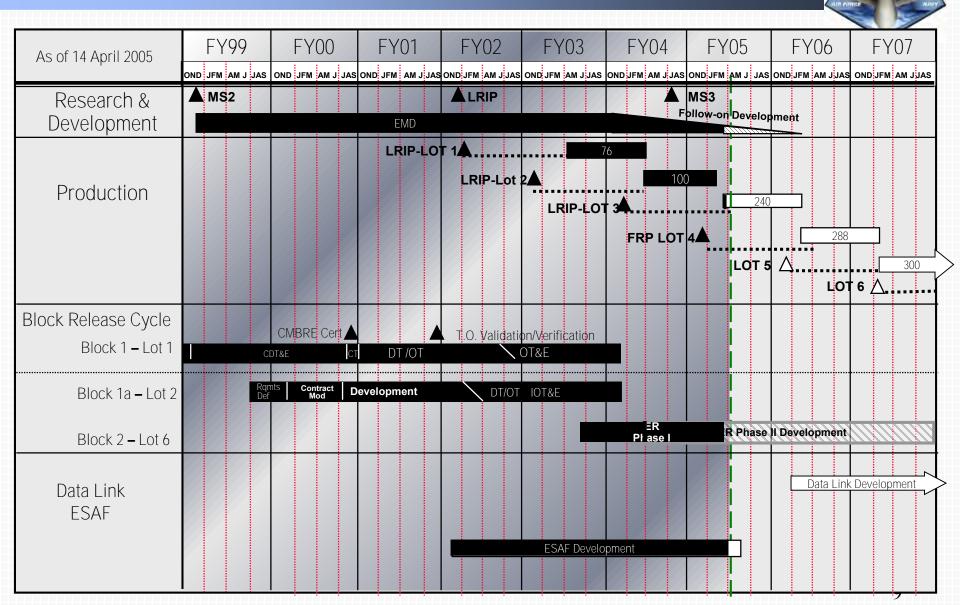


- Program Overview
- JASSM Capability Of Today
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  - JASSM Extended Range (JASSM ER)
  - Electronic Safe and Arm (ESAF)
  - Weapons Data Link (WDL)
  - Maritime Interdiction





## Top Level JASSM Schedule



# **CLEARED FOR PUBLIC RELEASE** JASSM Facility - Pike County Operations • Producing JASSM missiles since 1999 • > 290 missiles have been delivered to date • Facility supports required production rates • Shingo Prize winner for manufacturing excellence Production Line Hot Line through 2018Economies with USAF procurementOnline depot capability

- Production and System Engineering teams in place
  Integrated logistics support program



### VT-1 & 2 Test Results

### Insensitive Munitions Certification



**Fast Cookoff** 



**Fragment impact** 



Sympathetic detonation



**Slow Cookoff** 



**Bullet impact** 

NATO Insensitive Munitions Information Centre (NIMIC) Insensitive Munitions Award Citing "...the most significant advance in Insensitive Munitions (IM) technology in the NIMIC nations over the past two years." The award, named this year for Susan DeMay

## JASSM Topics



- Program Overview
- JASSM Capability Of Today
- JASSM Capability Of The Future
  - JASSM Extended Range (JASSM ER)
  - Electronic Safe and Arm (ESAF)
  - Weapons Data Link (WDL)
  - Maritime Interdiction



### What is JASSM-ER?



### This Is A JASSM



- Block 2 upgrade to JASSM
- PROGRAM GOALS
  - Provide same capability as JASSM with >500 nm range
  - Begin production with JASSM Lot 6 (Jan 07)

### This Is A JASSM-ER



#### RESULTING PHILOSOPHY

- SAME warhead, fuze, interfaces, outer mold line, coatings, mission planning architecture and model, etc. as JASSM
- Only changes are related to new engine, add'l fuel volume

### JASSM-ER Will More Than Double JASSM Range

### JASSM-ER Development Milestones





Subscale Wind Tunnel Testing Mar 03



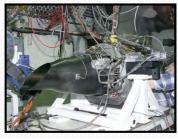
Engine Acceptance Test Dec 04



ER Full-scale Pole Model RCS Test Jan 05



Critical Design Review (CDR) Feb 05



Engine Development Testing Mar-Jun 05



Full-scale Wind Tunnel Testing Jul 05



Structural Testing May-Jun 05



B-1 IMV Flights Sep-Nov 05

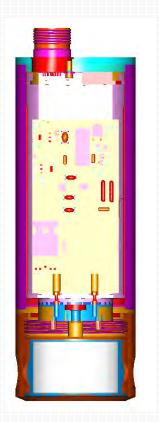


First Flight Test Apr 06

# Design, qualification, and flight testing of JASSM-ER configuration in time to support Lot 6 insertion

### JASSM Electronic Safe and Arm Fuze (ESAF)





### Objective / Description

- •Electronic In-Line Fuze No movable parts
- Performance requirements same as FMU-156/B
- Compatible with Mk94/BLU-109 fuze well
- Vented externally to support IM compatibility

**Product Upgrade Verification** 

### ESAF Development Milestones





Howitzer Testing October 04



Slow Cook-Off Testing December 04



Fast Cook-Off Testing December 04



Howitzer Testing June-August 05



Sled Testing June-December 05



Flight Testing
October – December 05

Design, qualification, and flight testing of ESAF in time to support Lot 5 insertion

### JASSM Weapons Data Link (WDL)

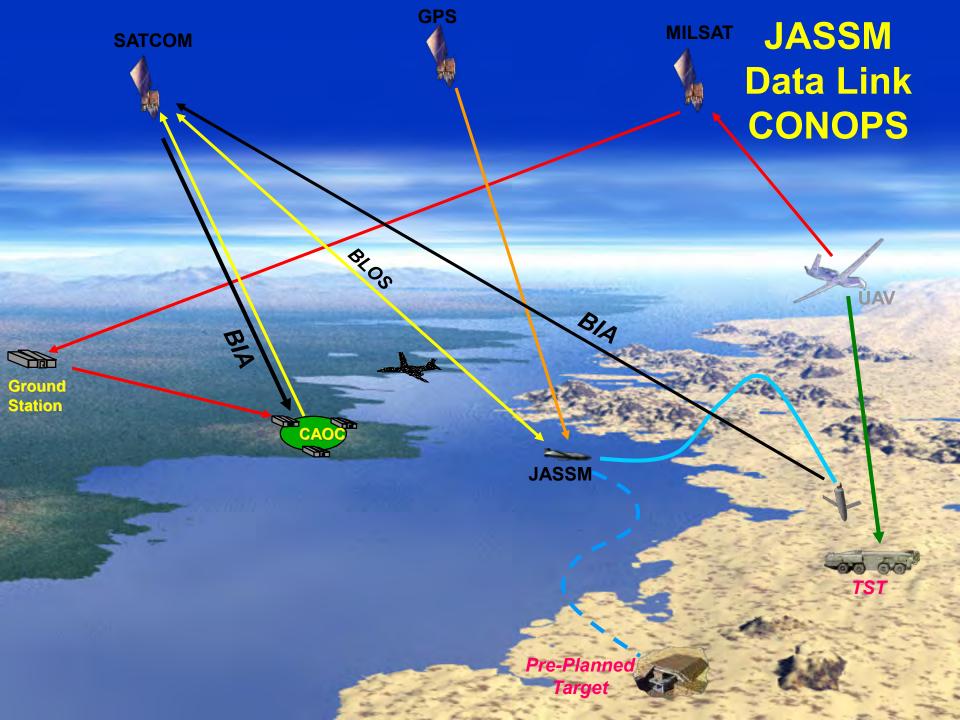


Modify JASSM's baseline one way data link into 2 way transreceiver

• Enables retargeting enroute

• Goal is to incorporate into JASSM ER by Lot 8





### JASSM Maritime Interdiction (MI)



- JASSM provides warfighter near-term opportunities to enhance MI capability
  - Tailored flight profile and seeker algorithms can be inserted into inventory missiles
- Added synergy with data link
- ASuW studies completed FY04 through USN funded task
- Supporting continued studies and concept refinement with ACC

JASSM Is Critical Component Of A System-Of-Systems MI Solution

### Summary



- JASSM is in the field and available for warfighter today
  - Multiple aircraft can shoot against high value, highly defended targets with unmatched effectiveness
  - Upgrades underway to increase already impressive baseline capabilities for JASSM of tomorrow
  - By Lot 8, will have 500 nm and range with retargeting inflight



### Precision Strike Association Annual Programs Review

### "Interdependency Across the Services"

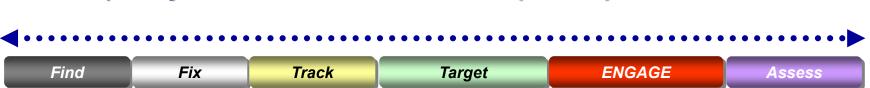
RDML Tim Heely
Program Executive Officer
Strike Weapons and Unmanned Aviation
19 April 2005





### Weapons Roadmap

- **INVESTMENT STRATEGY to leverage:** 
  - JOINT Development
  - JOINT Employment
  - CAPABILITIES-BASED investments; vice platform-centric
- Capabilities-based acquisition planning
  - From TARGETS back to platforms/weapons
  - Capability Across the *entire KILL CHAIN* (F2T2EA)







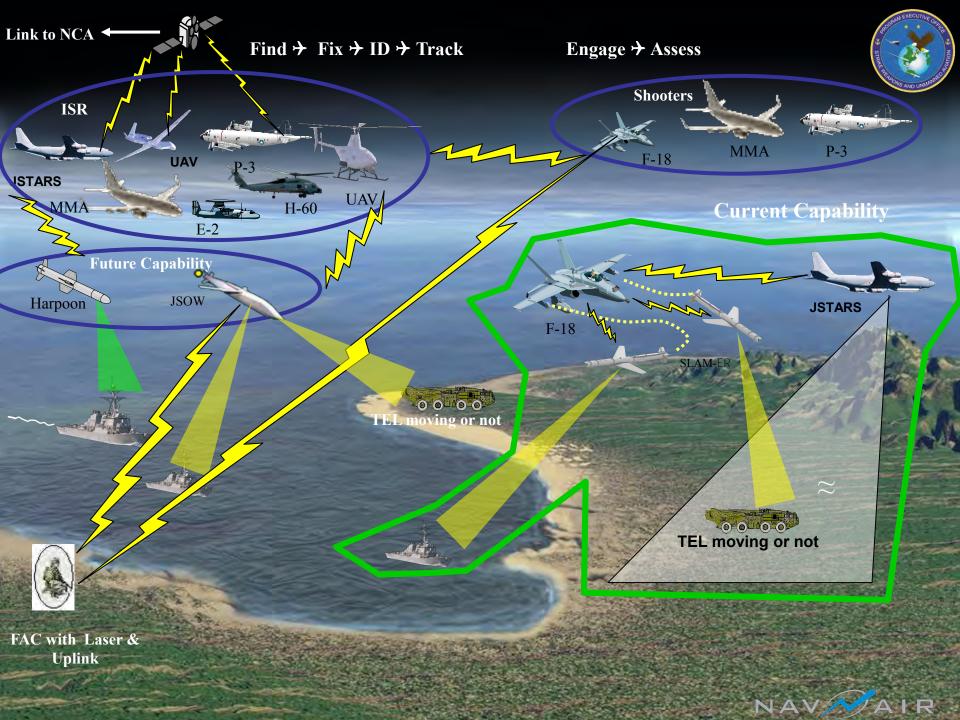


Standoff

Standof

SLAMER









### Interoperability Today

# Navy/Marine Corps weapons compatible with other services

- JSOW USAF
- JDAM usaf
- LGBs USAF
- HARM usaf
- Hellfire army & usaf
- 2.75 inch Rockets ARMY & USAF
- Maverick usar
- 20MM Gun Systems usar





### Cooperation for Tomorrow

#### APKWS

- Advanced Precision Kill Weapon System
- Army
- Interoperability with Coalition Forces
- Off-Board Interoperability with National Assets

#### HARM

- High Speed Anti-Radiation Missile (AGM-88 B/C)
  - AGM-88 C: United Arab Emirates
  - AGM-88 B: Germany, Italy, Greece, Turkey, Spain, South Korea

#### AARGM

- Advanced Anti-Radiation Guided Missile (AGM-88 E)
- Italy

#### JHSW

- Joint High Speed Weapon
- Potential Program to fill Capabilities Gaps
- In Joint Capabilities Integration & Development Process





"OSD identifies 50 goals for unmanned aviation in this Roadmap that support the Department's larger goals of fielding transformational capabilities, establishing joint standards, and controlling costs."

interoperability within each class of UAV and to maximize appropriate degree of interoperability between classes of UAVs.

To achieve UAV interoperability, standardization is required in the regimes of situational awareness, control, tasking, collection, processing and dissemination."

"Interoperability among UAV systems is critical in order to reduce acquisition costs, share sensor data among disparate users, ...."



### Moving Forward

#### • INTEROPERABILITY changes...

- The way we fight
- The way we approach the fight
- Sea Power 21
  - Critical Component of Joint Interdependence
- Integrated Networked force
  - Joint Services
  - Multi-national partners
  - Commercial assets

CAPABILITIES-BASED approach; seeking solutions "BORN JOINT"







# Precision Strike:

# Improving the Kill Chain

# Precision Strike Association Annual Programs Review 20 April 2005



LtGen Michael A. Hough Deputy Commandant for Aviation





# Precision Strike: *Improving the Kill Chain*

## Precision Strike: Kill Chain

FIND FIX TARGET TRACK



Key enabler: Command & Control

- Situational Awareness
- Precision Targeting
- Standoff
- Response Time
- Precision Lethality

Precision: A Warhead on a Forehead

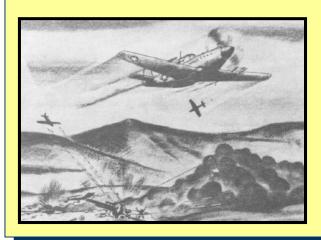


# Precision Strike: *Improving the Kill Chain*

Yesterday: Where we were

Today: Where we are

Tomorrow: Where we need to go









## Yesterday: Where we were

- Slow & limited intelligence & SA
- Limited precision
- Limited standoff
- Very slow response time
  - Dumb bombs
  - Dumb aircraft
  - Inaccurate coordinates
  - Operator skill & luck



## **Quantity versus Quality**



## Today: Where we are

- Intel & SA vastly improved
- Precision effects desired / required
- Major improvement in LETHALITY
  - Precise & Precision weapons
    - JDAM, Laser guided weapons
    - Precision aircraft
    - Precision coordinate generation in work
- Response time decreased

**Enhanced success on non-moving targets** 



## Today: Where we are

### KILL CHAIN IMPROVEMENTS

- Digital Communications / Targeting Systems
  - Accuracy, speed, coordinate pedigree
  - TLDHS (Target Location Designation Handoff Sys)
    - → Near-instant data transmission & processing
- 3<sup>rd</sup> generation FLIR
- Real-time video downlinks
- UAVs
  - Real-time situational awareness
  - FACs: greater engagement range
  - Armed UAVs shorten kill chain

Significant progress — more needed



# Target Location Designation and Handoff System Digital Control of the Property of the Propert

Digital Map & BFSA Overlays



### **TLDHS**

- USMC Today: Ground user to GPS weapons with NO human input
- Precision coordinate generation at the tactical level



Precise targeting interface









# Litening Pod Downlink

- Sensor downlink from aircraft "Rover.".
  - Developed by USMC for Offensive Air Support
  - Provides video from aircraft/UAV sensor to ground user
  - Pilot understands FAC FAC understands pilot:

SHARED SITUATIONAL AWARENESS





Real-time Collaboration shortens kill chain



# Today: NIGHTIME CAS AT 20 MILES AWAY

- Litening AT
  - AV-8B
  - Expeditionary F/A-18
- Shared Situational Awareness
- Night operations

### **RESULTS...**

- Near-precision effects
- Sortie efficiency!





# Kill Chain Today

- Weapon TLE is NOT the limiting factor
- We use precision weapons in an imprecise way
- Coordinate Generation is KEY
  - Quality
  - Timing
  - Digital Transmission / Error avoidance
  - Employment
  - Processing time & effort



## UAVs in the Kill Chain

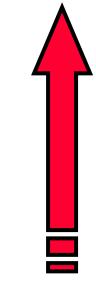
### Must be fully plugged into C2 Net

- >>> Seamless Integration
- >>> Operate within Kill Chain

### **Efficiency**

- Sorties
- Risk: aircrew vs. machines
- Capability: persistence/duration
- Survivability
- Cost: AV-8B = \$7K/hr, Tac UAV = \$300/hr
- IR pointer on Pioneer





We need a 3<sup>rd</sup> tier tactical UAV: Eagle Eye



## Today: Where we are

What is our best PS weapon today?

Real-time Targeting
Target Discrimination
Moving Targets
Intelligent Response
Accuracy: ±1 INCH

Today's model for precision strike



## Today: Where we are



Today's model for precision strike



## Tomorrow

- Command & Control SA & Intel
  Sea Shield & FORCENet
  - Networked Architecture
  - Interoperability
- Better Situational Awareness

- **\***Collaborative
- **\***Redundant
- An "Internet-style" architecture for all players?
- All users, platforms, weapons linked total visibility
- Drive down Response Time

## Compress the kill chain



## Tomorrow: Kill Chain

- Urban ops require increased precision
- **Marine on the ground needs...** 
  - Sophisticated system to acquire precision coordinates
    - Image processing
    - Mensuration
  - Microburst precision data to platform & operators
  - Platform data transmitted back to man on the ground
    - Coordinates refined & transmitted

### **USMC** will field soon with TLDHS



## Tomorrow: Kill Chain

# Marine on the ground needs...

- Sophisticated system to acquire precision coordinates
  - Image processing
  - Mensuration
- Microburst precision data to platform & operators
- Platform data transmitted back to man on the ground
  - Coordinates refined & transmitted

- Instant weapon programming
  - Air-launched bomb
  - Missile
  - ■Smart artillery/naval round
- It should all happen in an INSTANT!
- Simple user interfaces
- No voice comm

**USMC** will field soon with TLDHS



## Tomorrow

- Moving/Mobile Targets
  - Long range weapons targets move
  - Terminal guidance updates
  - Sensor-fused weapons
  - Guidance systems that can discriminate
- Today: LGBs, Maverick, Hellfire
- Joint Common Missile technology...

**Need "tag" for** mobile targets

- NETWORKS
  - "Internet" for all players weapons linked in
  - Limiting factor becomes *response time*, not accuracy

Making the kill chain more effective



## Concerns

- Joint Policy
- Joint Training
- Joint Equipment
- Joint Architecture

## This is not easy...

We need your help



## Tomorrow



What we do today

Will determines the steps we take tomorrow

R R

**FUSION WITHIN THE KILL CHAIN** 



## Advanced Technology

## MARINES:

Our best platform

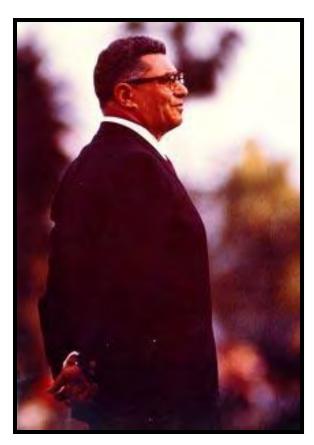






## How we will make this happen

## Leadership













## Precision Fires Rocket and Missile Systems



## Guided MLRS

## Full Spectrum Precision With Scalable Effects



LTC Stephen Lee

Product Manager GMLRS

Precision Fires Rocket & Missile Systems (PFRMS)

Phone: (256) 876-5727 (DSN 746)

stephen.lee@msl.army.mil

19 April 2005



ANY SOLDIER, ANYWHERE, ALL THE TIME

UNCLASSIFIED



## Agenda



- Program Overview
- What GMLRS Brings to the Warfighter
- GMLRS Urgent Need
- Conclusion





### GMLRS Evolution to Precision Strike





Extended Range Rocket (M26A1 / A2)

Guided Rocket (XM30)

Guided Unitary Rocket

Cargo / Unitary P3I

1980

**EVOLUTIONARY** 

1998

REVOLUTIONARY

2000

User Requirements

Range

*Flexibility* 



45 Km









Precision / Accuracy

Maneuver Safety

Detent

Deeper Targets

Farther Laterally
"General Support (GS)"

Mission

Inertial Measurement Unit (IMU) / Global Positioning System (GPS) Aided

Deeper Targets Farther Laterally "GS-Reinforcing" GPS Aided / IMU

GPS Aided / IMU

Deeper Targets Farther Laterally "**GS" Mission** 

R, GSR

Payload Dual Purpose Improved Conventional Munition (DPICM)

5% Dud Rate

4% Dud Rate / < 1% with M101

Set Back

**DPICM** 

Threshold: < 2 / 4% Dud Rate Objective: 0% Dud Rate

Set Back Dwell Time

Mission

DPICM

Unitary with Multi-Option Fuze

NA

Not ID'd

TBD

TBD

Hard Stationary Point Targets
Soft Collateral Damage Sensitive
Soft Area Targets

Set Back Dwell Time Set Back Dwell Time

Area

Survivability

**Targets** 

Full Spectrum With Scalable Effects & Range

Point

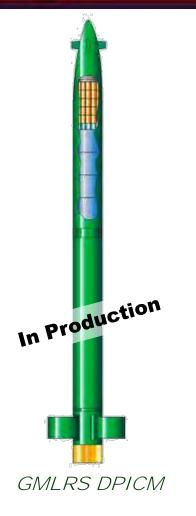
Any Soldier, Anywhere, All The Time

PF-0175 4/13/05



### GMLRS Variants







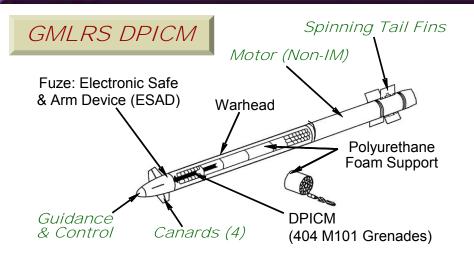




Spiral Development for Full Spectrum Precision Capability

### GMLRS DPICM / GMLRS Unitary Comparisons

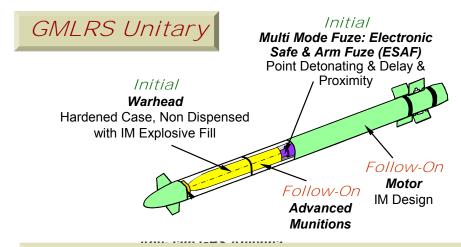




## Common Design Items Between GMLRS DPICM & Unitary

- Guidance & Control
- Canards
- Motor = Non IM
- Spinning Tail Fins

- Pod
- Common SW
- Maintainability
- Supportability



#### Design Items for Initial

- · Warhead with IM Design
- Multi Mode Fuze: <u>DPICM ESAD Modified to Unitary ESAF</u> with PD, Proximity & Delay Capabilities
- Unique Unitary SW

#### Design Items for Follow-On

- Motor = IM Design
- CAIV Initiatives
- Rocket Pods

- Other Technology Opportunities (OTO)
  - Pit Stop

POTENTIAL GMLRS Unitary Spiral Design Improvements For Future Increments and / or Blocks



### GMLRS DPICM Provides Full Spectrum Support



## GMLRS DPICM is the Foundation of Future Precision (Unitary) and Smart Munitions

- Increased Range, Accuracy, and Effectiveness
- Decreased Logistics Throughput Per Target (Average 6 to 1 Advantage in the Number of Rockets Over M26)
- Basis for Transition to Precision / Smart Rocket Munitions
- HIMARS + GMLRS: Key Systems in Fires Brigade
- Mitigates the M26 Shelf Life Issue
- Reduction of Unexploded Ordnance (UXO)

Provides Spiral Development Improvements that Support Fires Unit of Action Munitions Capabilities (ATR, Loiter, BDA, Intel . . . )



## GMLRS Value Added to the War Fighter



Assumptions:

All Rounds Fired at Their Max Range, 30% Expected Fractional Damage, 50m Target Location Error, Against a Given Target

MUNITION	ROCKETS	COMMITMENT
M26 (32km)	75 rockets	6 launchers – 19 min, 1 M270A1 Reload = 1 Battery
M26A2 (45km)	122 rockets	6 launchers – 19 min, 5 M270A1 Reloads = 1 Battery
M30 (70+km) GMLRS	15 rockets	2 launchers – 2 min, No M270A1 Reloads = 1 Platoon (-)
M30 (70+km) GMLRS	15 rockets	3 launchers – 2 min, No HIMARS Reloads = 1 Platoon

GMLRS Allows the Other Launchers Within the Battery to Service Several Targets Simultaneously



## Decreased Logistics Throughput

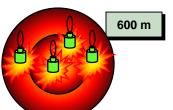






















**Effectiveness Comparison** 

30% Damage Level









**Guided Unitary Target Elements** 





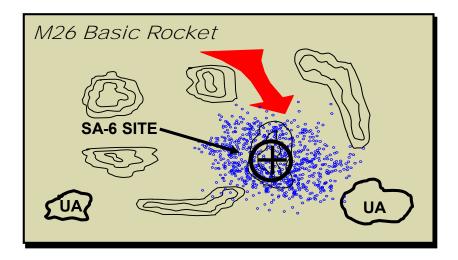
Multiplicative Effect of Reducing the Logistics Throughput = Decreased Fuel, Transports, Transporters, Maintainers, Medics, Cooks, Etc.

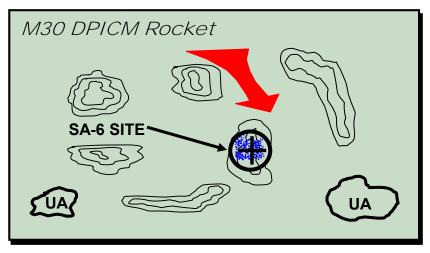


### Bottom Line



- GMLRS is a Vast Improvement Over Our Current Free-Flight Rockets
- Increased Effectiveness with Fewer Rockets
- Allows for More Targets to be Serviced in the Same Time Frame
- Reduces the Hazardous Area for Maneuver Forces
- Provides Planners the Ability to Select Maneuver Routes with Confidence





Significantly Improved Maneuver Safety – 95% Reduction In Duds and a 99.6% Reduction In Hazardous Area



### Latest on SDF Status



#### **KDI** Design

- Critical Failure in M915, Sister Program
- "Late Riser" Issue
- Will Still Conduct PQT Although Results are Questionable
- KDI is Working on Get Well Plan

#### Bulova Design

- Will Deliver SDFs For Two-Rocket Design Verification Test
- Given a Successful DVT Will Move Immediately to PQT
- Pyro-Technical Design Based on Current M101

#### Junghans-Giat and ATK

Strategic Decisions To Withdraw From Consideration



**KDI** 

Leader In

SDF

**Production** 

## SDF Path Forward for GMLRS



*FY05* 

*FY06* 

*FY07* 

#### LINE QUALIFICATION

(Inert Fuzes & Inert Grenade Bodies)

1,000 for Lone Star Army Ammo Plant

6,000 Inert (uz) Inert (ven) for Lookneed Martin in Camden, Arkansas

#### PRODUCTION QUALIFICATION FLIGHT TEST



Pocket Payload - 3,636 Live Fuzes / Inert Grenades

- Incorporate Partial Stockpile To Target Sequence and Accelerated Shelf-Life Testing
- 2 Rockets Each Hot-Long, Hot-Short, Cold-Long, Cold-Short, & 1 Rocket Ambient

#### LEADER

If
Affordable
and
Effective.....

....Procure
No More
Than
1Million
SDFs

Procure No
More Than
2.8 Million
SDFs From
Either
Source

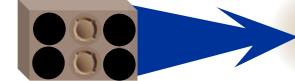
#### FOLLOWER CANDIDATES

JUNGHANS - GIAT ATK, or Bulova

Second Source in SDF Production

#### DESIGN VERIFICATION TEST

**Production Verification Test** 



Down Select
"Second
Source"

Two Rockets

#### *FOLLOWER*

Production Qualification Testing

Dec 06,
Deliver First
Rockets with
SDFs to
the UK

Two Qualified SDF Sources by FY05

Any Soldier, Anywhere, All The Time

PF-0175 4/13/05



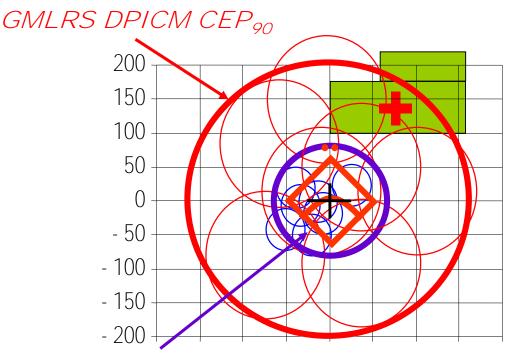
## GMLRS Unitary Warhead Collateral Damage Reduction



Point Target in Restrictive Environment

Engagement with randomly generated impacts at 40km range, TLE = 50m





GMLRS UNITARY CEP90





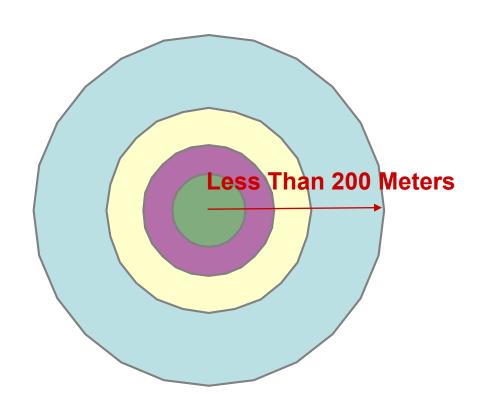


## Approximation of GMLRS Unitary and DPICM Warhead Scalable Effects





- GMLRS Unitary Air Burst
- GMLRS Unitary Ground Burst
- GMLRS Unitary Delay



GMLRS Unitary Effects Are Concentrated About Point of Detonation and Quickly Taper Off



### Scalable Effects



#### **DPICM**



Point Detonating Fuze



### Proximity Fuze



Delay Fuze

## Military Equipment Shielded by Civilian Buildings

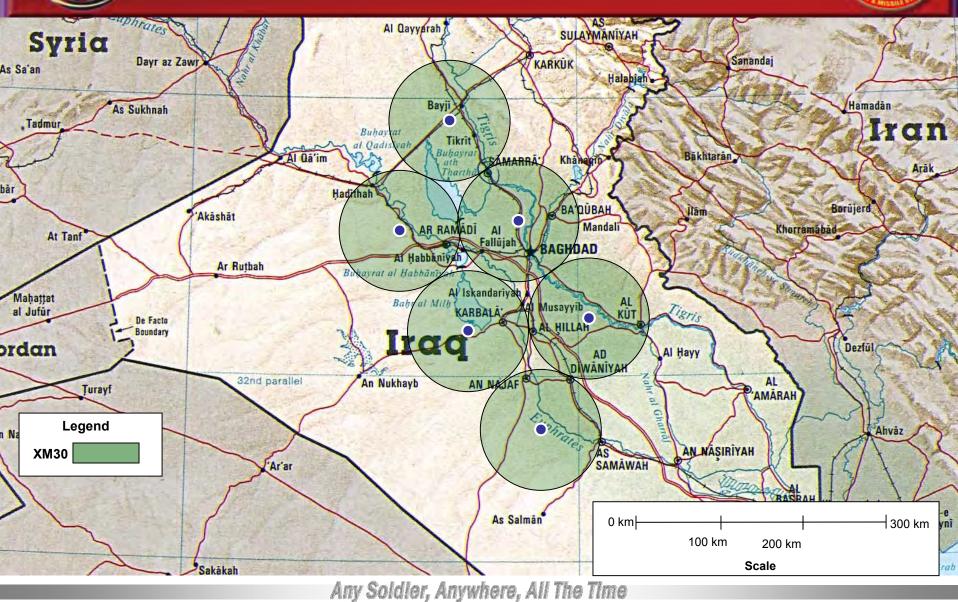


Iraqi Bunker



## Scalable Area of Influence







## Scalable Response Time



RADAR = > > Launcher w/Enhanced C2 = > > Guided Unitary Rocket

Auto processing turned on at Radar

Stay Hot Shoot Fast







160 meters



700 meters



1050 meters

Effects Timelines Reduced to Less Than 2 Minutes



## GMLRS Unitary Urgent Need



#### **UMR Facts**

- Begin Deliveries of Accelerated GMLRS Unitary Rockets As Soon As Possible, but NLT Jun 05
- Expedite Deliveries to CENTCOM Theater
- Field 75% of a Battery Basic Load (486 Rockets)
- Field A Dual Mode Fuze Capability (Point Detonate and Delay)
- Priority is M270A1 First and HIMARS Second Both By Jun 05
- Qualify the Rocket as Safe and Suitable AEC Assessment will Include Effectiveness
- Achieve a Limited Safety Release
- Obtain Urgent Material Release
- Upgrade Additional Launchers to a GMLRS Capability
- Spiral GMLRS Unitary Initial Capability to Full ORD Requirements

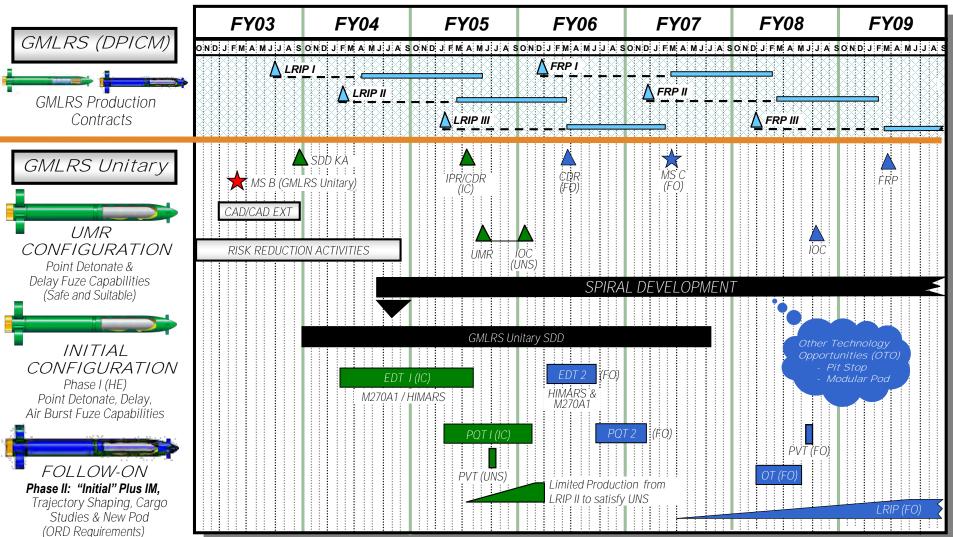
#### Path Forward

- Urgent Need Statement (UNS)
  - "This is What I Want" (LTG Metz, 12 Oct 04)
- Validated Urgent Need Statement (UNS) by G-3/5/7
  - **"We Agree You Need It"** (LTG Lovelace, 06 Jan 05)
- IM Waiver Request
  - "JCB Recommends Waiver Approval and Paper JROC"
- Safety Assessment (AMCOM)
  - "It Will Work with Manageable Risk"
- Acceptance of Conditions by Gaining Command
  - "We will Take It" (LTG Metz)
- Urgent Material Release Approval
  - "Send It" (MG Pillsbury)



## GMLRS Unitary Schedule







### Conclusions



- GMLRS is a Significant Capability Available Today
- Together with HIMARS
   Creates Unprecedented
   Capabilities at an Affordable
   Cost
- Is Needed by the Warfighter
   TODAY!



Bottom Line: GMLRS Provides Unprecedented Full Spectrum and Scalable Effects

## Back-Up

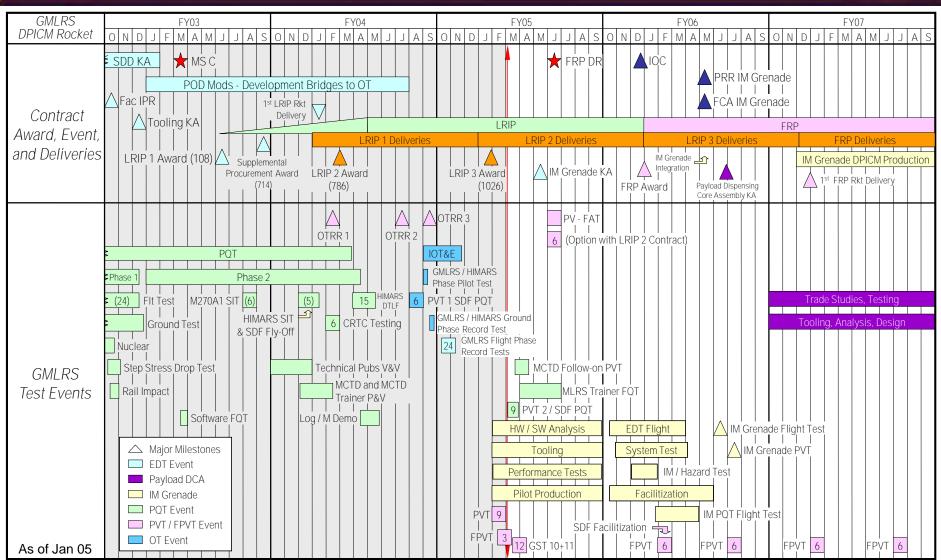






### GMLRS DPICM Schedule







### GMLRS DPICM



#### System Description

- Integrated Guidance & Control (G&C)
   Package
- Achieves Greater Range & Precision Accuracy
- Improved Accuracy Reduces the Number of Rockets Required to Defeat Targets
- 5 Nation Cooperative Development Program

#### Key Performance Parameters (KPPs)

- Range: 60 km (max) / 15 km (min)
- Effectiveness: 30% Expected Fractional Damage
- Rocket Reliability: Threshold: 92%; Objective: 95%
- Safety and Health: <2% Hazardous Dud Rate (<4% Less than 20 & Greater than 60 km)

#### Accomplishments Last Six Months/Status

- Log and Maintainability Demo
- Successful Operational Test (OT)
  - Ground Phase Conducted 20 Sep-1 Oct
  - Flight Phase Conducted 13 Oct-3 Nov
- LRIP III Contract Awarded 31 Jan 05
- On track for FRP Decision

#### Next Six Months

- Stockpile-to-Target Sequence (4 x HIMARS)
- PVT-2/PQT of KDI SDF, 25 Mar 05
- FRP IPR, Jun 05
- Multi-Year Procurement Decision Package



## GMLRS Unitary



#### System Description

- Provides Complimentary Capability to DPICM (where use of submunitions are not effective or desirable)
- Single 200 lb High Explosive Warhead
- Effective Against Critical Area & Point Targets Located in Restrictive Terrain

#### Key Performance Parameters (KPPs)

- Min / Max Range: 15 / 60 km
- Effectiveness: Functional Kill with Point Detonating & Delay Fuzes
- Effectiveness: 30% EFD with Proximity Fuze
- Rocket Reliability: Threshold: 92% Objective: 95%

#### Accomplishments Last 6 Months / Status

- EDT-1, 1a & 2 Flight Test in PD Mode
- GMLRS Unitary HE Warhead Arena Tests
- Converted to 3 Inch Standard Fuze Design
- EDT-4 and 8 in Delay Mode
- EDT-7 in Proximity Mode

#### Next Six Months

- Field Contingency Quantity of Rocket to OIF / OEF
- EDT Ground Tests
- Complete EDT Flight Tests
- LIT/SIT With HIMARS & M270A1
- · Start Production Qualification Testing

## Target Sets Guided Rocket Family of Munitions



#### Target Categories

- 1. Personnel
- 2. Materiel

**Elements** 

Personnel

Structures

Weapons

Vehicles

3. Structures

# DPICM

## Hard / Soft Hot / Cold Moving / Stationary Emitter / Non-Fmitter

**DPICM** 

#### Payloads

- 1. DPICM
- 2. Unitary
- 3. Smart

Materiel

Personnel

Target

#### Environment

- Open
- Woods / Urban
- In Buildings
- Fortifications
- Close To:
  - Friendlies
  - Non-Combatants
  - Protected Sites

UNITARY

Restricted Terrain

Protected Positions

Collateral Damage Concerns

Unitary Fills a Critical

Warfighter Deficiency

Structures

Venn diagram intended to describe target set. Size does not indicate target density.

Any Soldier, Anywhere, All The Time

UNCLASSIFIED

PF-0175 4/13/05



## GMLRS Provides Significant Capability



The Complementary Nature of GMLRS with Unitary and DPICM Warheads Make GMLRS a Formidable Weapon in All Future Contingency Operations





## Demonstrated Accuracy - Demonstrated Lethality



### GMLRS Unitary Operational Effectiveness Example









Basic Rocket

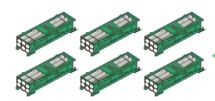




Guided Unitary







**Effectiveness Comparison** 

30% Lamage Level









**GMLRS Unitary Target Elements** 





Personnel / Materials

GMLRS is more effective than Unguided Rockets against all targets



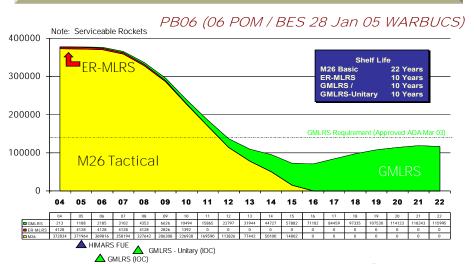
## IM Waiver & Compliance Summary



#### System Description

- GMLRS Rockets have an Integrated Guidance and Control (G&C)
   Package & are Used by M270A1 & HIMARS Launch Platforms
- GMLRS Rockets Achieve Greater Range & Precision Accuracy
- GMLRS Rockets Reduce UXO
- Replaces Current Inventory of Aging M26 Basic Unguided Rockets
- Two Variants-GMLRS DPICM & GMLRS Unitary

#### MLRS Rocket Inventory Concept



#### Waiver Request

- GMLRS DPICM & the Unitary Urgent Need (UNS from MNC-I)

  Quantities are not IM Compliant
- GMLRS DPICM will have IM Motor Improvement Production Cut-in FY07; RDT&E Effort in Place for Warhead Improvement
- GMLRS Unitary SDD Includes System Level IM Compliant Design; UNS Precludes IM Motor Availability & Warhead is Initial IM Design
- Request Waiver for Limited Production Army & USMC GMLRS Rockets Through FY06 (~4,662 of Total 100,000-140,042 or <5 % of Total Quantity)

#### Correction of Deficiencies

- Replacement of Non-Compliant Explosive M101 Grenade Fill with Compliant Fill for GMLRS DPICM
- IM Motor Being Developed under GMLRS Unitary SDD to be Cut Into GMLRS DPICM Production After Qualification
- Trade Studies of Alternate Launch Pod Container Materials for Improved IM Response with Follow-on Redesign Activity...Accelerated
- Payload Dispensing Core Assembly IM Characterization Test to Determine Vulnerability to IM Stimuli; Trade Studies and Potential Redesign Effort to Follow...Accelerated
- GMLRS Unitary SDD Contains Requirement for System Level Compliance

Any Soldier, Anywhere, All The Time



## Viper Strike Fielded and Ready!





Precision Strike Annual Programs Review Arlington, VA

19-20 April 2005

UNCLASSIFIED Unrestricted Release LTC John Oxford PM Submunitions

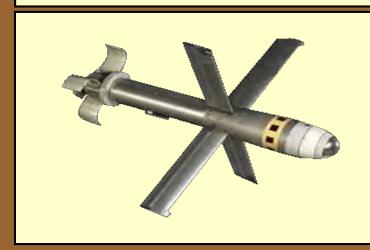


## Viper Strike Major Components

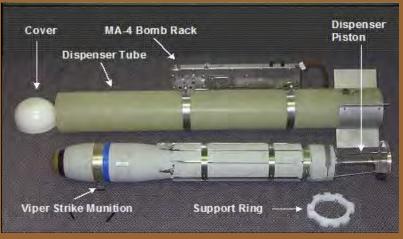
UNCLASSIFIED

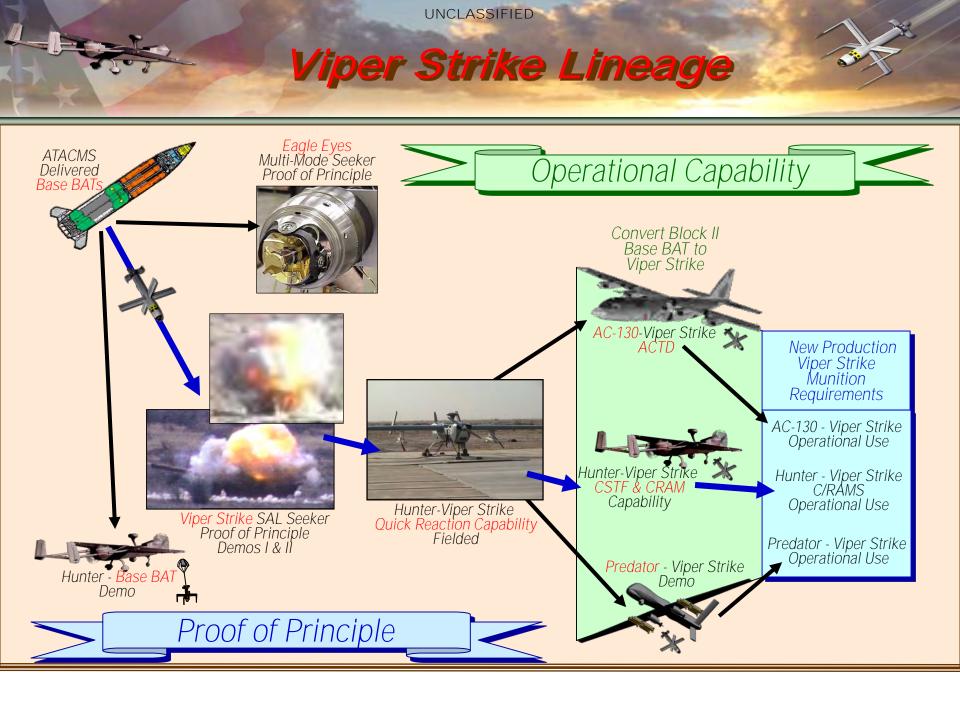


- · 48lb Precision Munition
  - Semi-Active Laser Seeker
  - Near Zero CEP
  - Small size/weight warhead
  - Nearly impossible to countermeasure
- Munition, Airframe, & Seeker being produced or recently in production
- Successful Validated Demos
  - Mar '03 6 of 7 engagements
  - Jul '03 9 of 9 engagements
- Quick Reaction Capability fielded to MNC-I



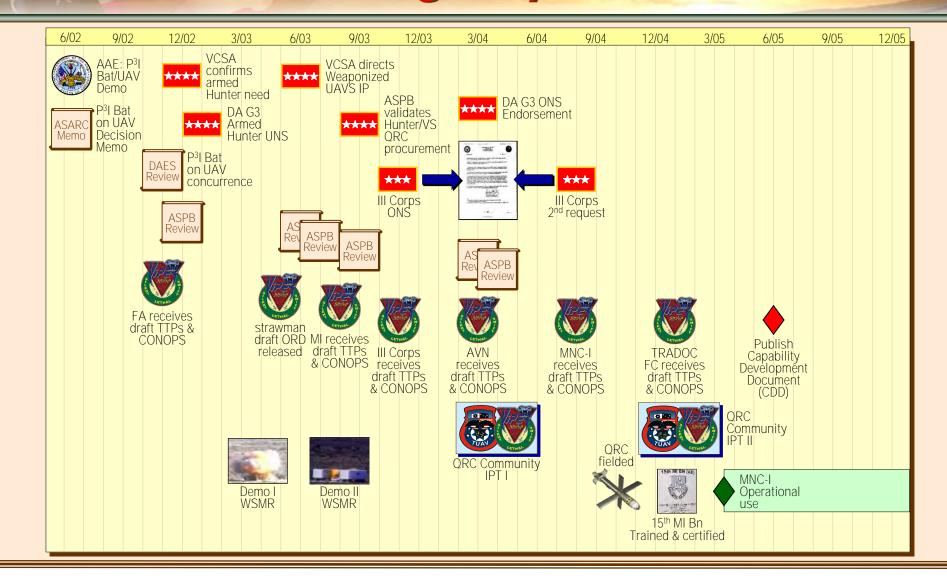






## Viper Strike's Evolving Requirement







## Quick Reaction Capability



### Operational Needs Statement:

- Provide Training, Crew Certification, and Tactical Viper Strike Munitions to MNC-I in support of Operation Iraqi Freedom
- 2 Army Hunter Viper Strike Equipped UAVs
- 8 Training/Crew Certification Munitions
- 25 Tactical Viper Strike Munitions
- 2 Contractor Logistical Support Munition Handlers

\$3.6M FY05 Supplemental funds provides 45 additional Viper Strike Munitions to OIF for CSTF/CRAM Efforts



## Current Capabilities



- "Golden Shots"
  - Pinpoint a moving armored car in a motorcade
- Restricted (Minimal Collateral Damage) Urban Targets
  - Reach down into cordoned urban canyons
  - Near vertical angle of attack projects warhead shrapnel into the target and ground minimizing collateral damage
- Convoy & TOC ISR & Security
  - At 10k' AGL, UAVs relatively unseen, unheard, and undetectable
  - Allows observation of enemy preparations and ambush points
- Key Infrastructure ISR & Armed Response
  - Refineries, pipelines, politically sensitive locations, etc.
- Monitor critical situations with timely response
  - Undetected observation without ground troops in harm's way
- Army asset under Army control







Fire Scout 4-6 Munitions







7 Armed Carriers, 14-28 Munitions, in the UEx, Fires Brigade, UAV Company

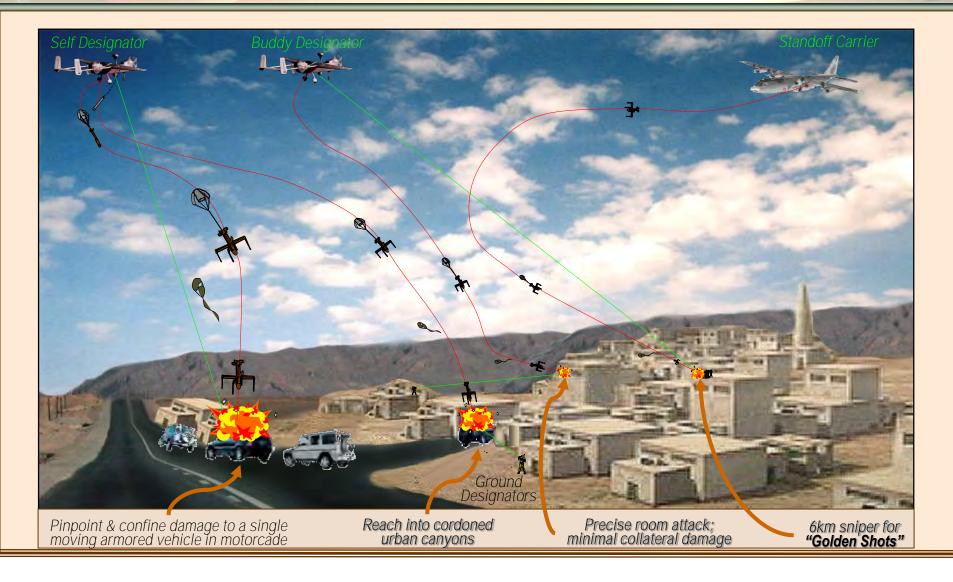


**Other Carriers** 

# Future Capabilities

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## Take Away Message . . .



#### Several Concurrent Efforts . . .

Requirements, TTPs, and CONOPS

Operational Missions in theater

Various user demonstrations being planned

Follow-on munition production and sustainment issues



# Viper Strike's Greatest Hits July 2003













# "US Army Precision Fires"

**BG(P) Jeff Sorenson** 



## **AGENDA**

- Precision Fires Why and Why Not?
- Misconceptions
- Target Acquisition
- Equipment Programs
- Key Planning Studies Underway
- Challenges
- Road Ahead

## PRECISION MUNITIONS -- WHY?

- All-weather, terrain, and operational environment engagement capability that reduces operational risk by providing immediate responsive fires and scalable effects
- Minimize collateral damage, especially in urban settings; allows for discriminating use of force
- Reduce number of rounds needed to defeat targets at all ranges (same CEP at any range)
- Reduce logistics footprint and force burden
- Essential to fulfill objectives of Transformation and Joint opns
- Compliment -- <u>not</u> replace unguided or 'dumb' munitions



## PRECISION MUNITIONS – WHY NOT?

- Not every target needs to be destroyed suppression, masking, or harassing fire is often needed to shape the battle
- Unaffordable <u>if</u> chasing too many programs with limited resources
- Insufficient numbers if they become the weapon of choice
- Dependent on sensor system data, rapidly passed networked information, especially when addressing fleeting targets
- PGM technology is developing ahead of doctrine and infrastructure modernizing weapons without modernizing doctrine may lead to ineffective use of PGMs

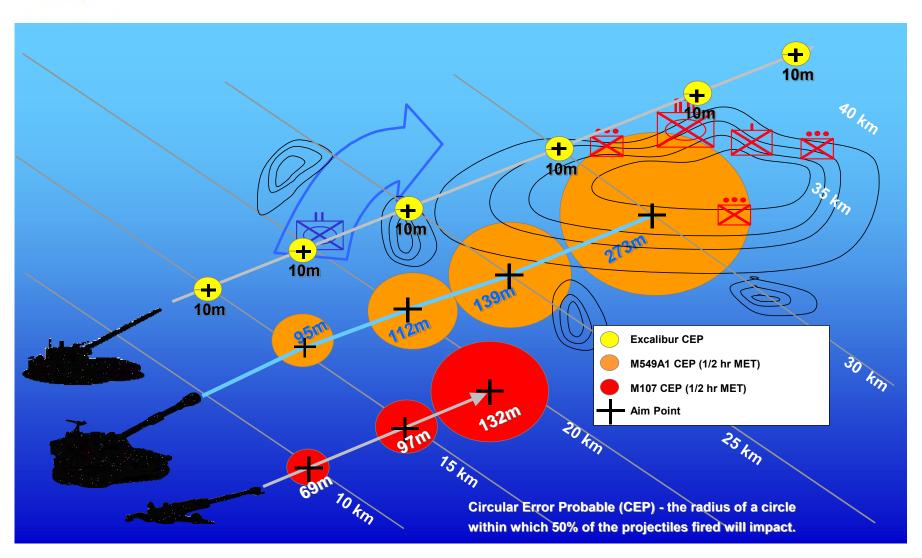


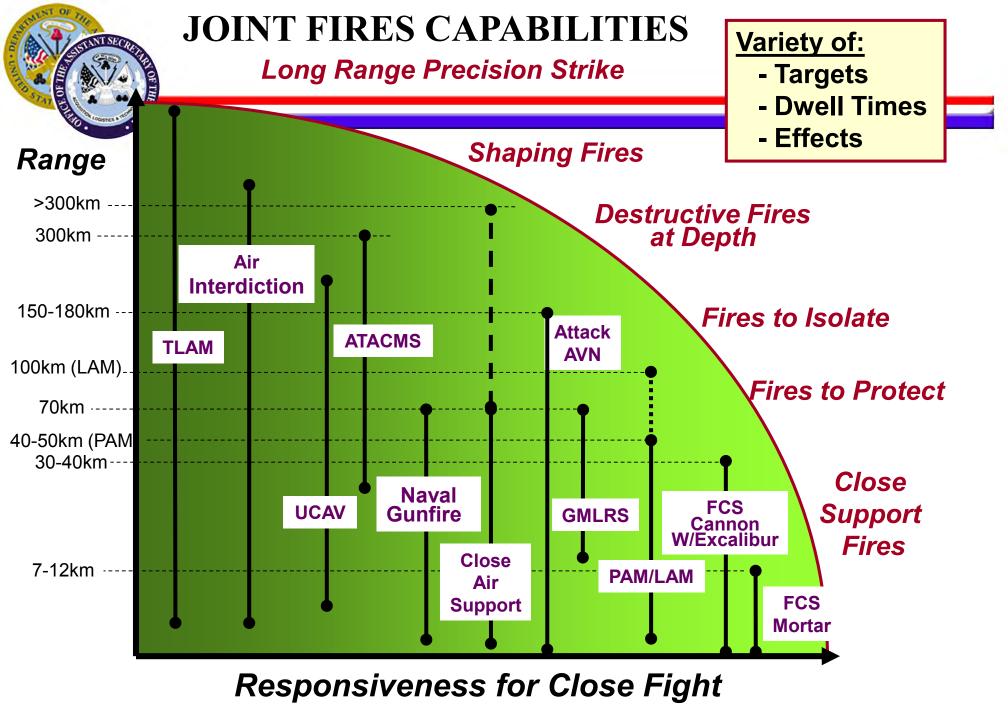
## **MISCONCEPTIONS**

- A replacement for unguided munitions but "dumb" is still good
- A leap-ahead advantage but temporary since eventually precision will proliferate and put our own forces at risk
- Leads to quick victory but the enemy does not always behave the way we think we would
- Technology Will Save Us...
- -- PGMs are not a replacement for sound tactics or strategy (do not confuse the ways and means of war with its end)
- -- PGMs as the 'silver bullet' but weapons break; human error; enemy countermeasures; not a replacement for doctrine, tactics, or the human element (leadership; will to win; luck)



## CIRCULAR ERROR PROBABLE (CEP)







### PRECISION MUNITIONS (Fielded & Developmental)

#### **FIELDED PRODUCTION SYSTEMS:**

TOW 2B JAVELIN

HELLFIRE variants -- SAL (K, M, or N) and LONGBOW (L) ATACMS Block IV – Quick Reaction Unitary (QRU)

### **SYSTEMS IN DEVELOPMENT OR S&T:**

PEO AMMO: PEO MISSILES and SPACE:

**Excalibur LOSAT Viper Strike** 

PGMM CKEM NLOS LS -- PAM

MRM APKWS NLOS LS -- LAM

CCF JCM MTHEL

**GMLRS** 



# **Air Armament Center (AAC)**

AAG





# Air Armament Center (AAC)



- Provides Weapons And Combat Support Systems To AF, Navy, Army, And More Than 30 Countries
- Strategic Advantage: Laboratory, Acquisition Offices, Developmental And Operational Test Organizations Are Colocated At The AAC



**AFMC/ AAC Mission** 

Deliver War-winning Technology, Acquisition Support, Sustainment,
And Expeditionary Capabilities To The Warfigher

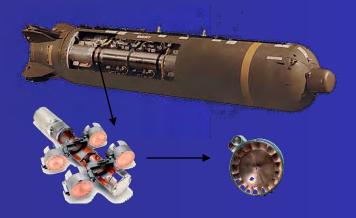
WIR ARMAT



Air-to-Ground Munitions Systems Wing (AGMSW)



Joint Direct Attack Munition (JDAM)



Sensor Fuzed Weapon (SFW)



Small Diameter Bomb (SDB)



# Air-to-Air Missile System Wing (AAMSW)



Advanced Medium-Range, Air-to-Air Missile (AMRAAM)

Harm Targeting System (HTS)

Sidewinder AIM –9X

Miniature Air Launched Decoy (MALD)

QF-4 Full Scale
Target



Air Force Sub-Scale
Aerial Target (AFSAT)



# Air Combat Support Systems Group (ACSSG)

All Purpose Remote Transport System (ARTS)





Universal Munitions Trailer (UMT)

Large Shelter System (LSS)



Munitions Assembly Conveyor (MAC)



# JDAM For OEF And OIF The Future?



- Prior to 11 Sept 01 Attacks
  - 700 Units Per Month
  - Aircraft

MK 82 (500 lb)	MK 83 (1000 lb)	MK 84 (2	( <mark>200</mark> 0 lb)	
None	F/A-18 C/D	F-16 Blk 50	F-14	
		F/A-18 C/D	B-2	
		B-52	B-1	

#### Today

2800 Units Per Month

More Aircraft Integrations - Smaller Bombs

MK 82 (500 lb)		MK 83 (1000 lb)	MK 84 (2000 lb)			
B-2	F-15E*	F/A-18 C/D	F-16 Blk 50	F-14		
F-16 Blk 30*	F/A-18 C/D	F/A-18 E/F	F/A-18 C/D	B-2		
F-16 Blk 40*	MQ-9* (FY06)	AV-8B	F/A-18 E/F	B-1		
F-16 Blk 50*	B-1 (FY06)	F-22 (FY-06)		B-52		

<sup>\*</sup> Quick Reaction Capability

Precision + Low Collateral Damage + Platform Flexibility in Months Vice Years



# **Preparing For The Future**



- Small Diameter Bomb
  - Field More Precise, 250 lb Bomb In FY06
- Universal Armament Interface
  - Develop Plug-and-Play Aircraft/Weapon Interfaces
- Net-Ready Weapons
  - Establish Interface Standard For Weapon Data Links
    - ACTD FOR SDB, JASSM, JSOW-C, MALD-J
- Directed Energy Application Are We Ready?
  - 8-10 Feb 05 Workshop Focused On Transition
- Armament Symposium 4-5 Oct 05
  - Focus Areas: CBRNE, CAS, Long Range Strike





## Non-Line-of-Sight Launch System

# Program Update

19 April 2005

Rod Summers
Director
NLOS-LS Task Force
256-313-1049
rod.summers@msl.army.mil

ANY SOLDIER - ANYWHERE - ALL THE TIME



## Briefing Summary

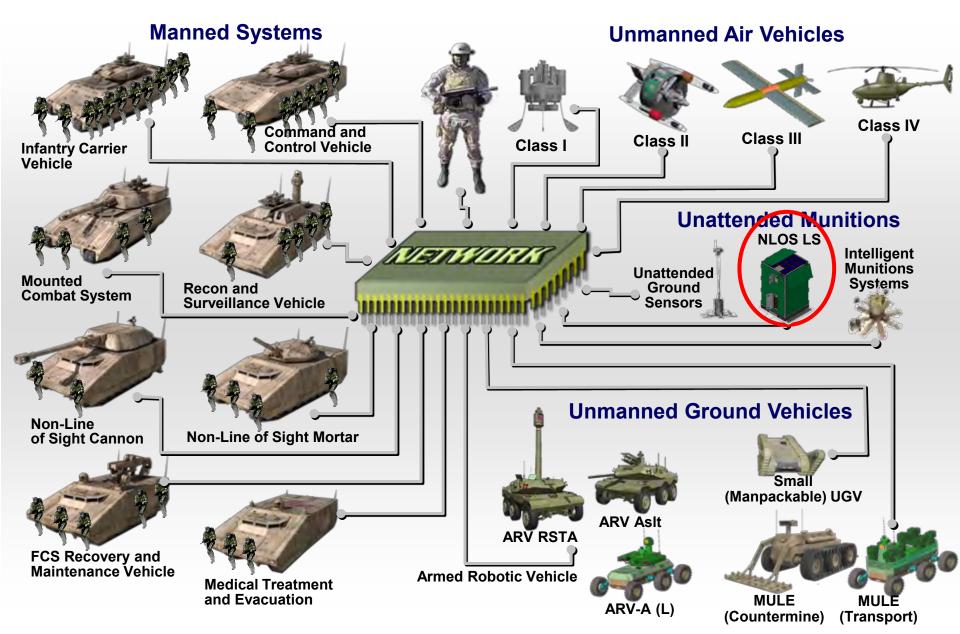


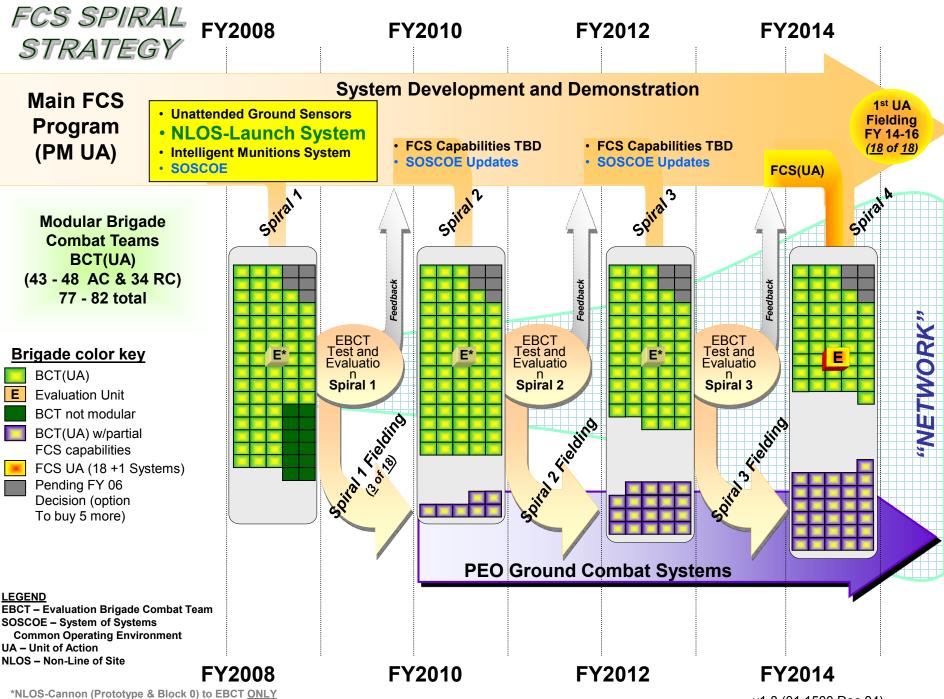


- Overview Information
- Program Restructure
- Selected Program Accomplishments
  - PAM
  - LAM
  - CLU
  - Networking and Communications
- Supportability Concept
- S&T Strategy
- Take-Aways

BLUF: NLOS-LS Program On Track Supporting FCS Spiral 1

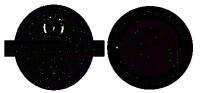
## FCS System-of-Systems





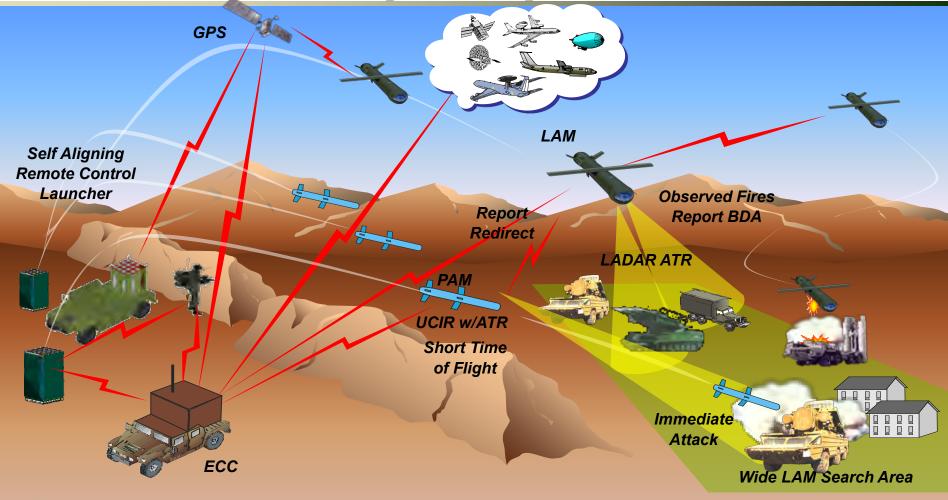
\*NLOS-Cannon (Prototype & Block 0) to EBCT ONL NL-0011 NLOS-LS to PSA (Apr 05)

v1.8 (01 1500 Dec 04)



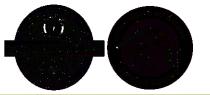
# NLOS-LS Concept of Operation







Be Highly <u>Deployable</u> and <u>Platform Independent</u>



# Why is NLOS-LS in Spiral 1?

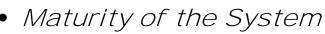




 Has ability to <u>overcome large TLEs</u>, <u>precisely</u> kill hard and soft targets that are <u>moving</u> or stationary by <u>target designation</u> or <u>autonomous means</u> from stand-off ranges



 Offers joint forces tremendous flexibility across a spectrum of conflicts with <u>efficient</u> <u>logistics</u>, <u>ease of transportability</u>, and greatly <u>reduced collateral damage</u>



 Program has been under contract since 1998 and had numerous successes



 Gives current forces a major piece of the FCS lethality capability now



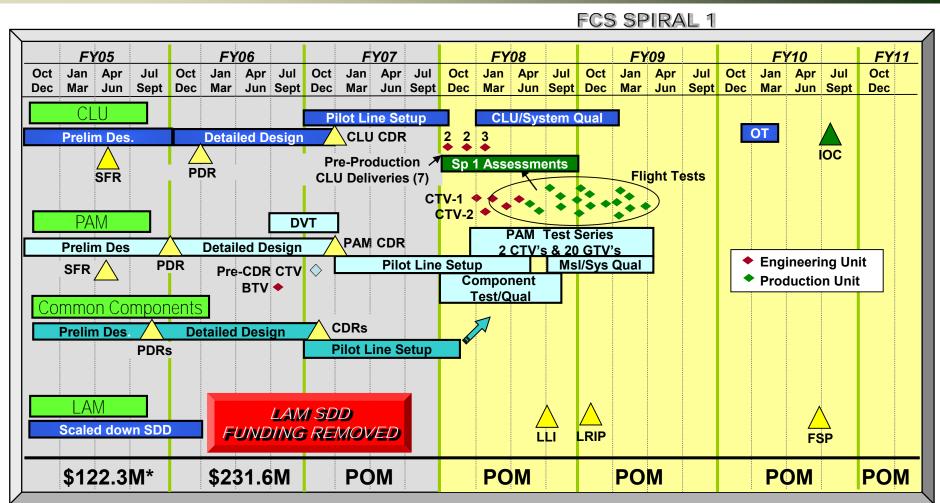
NLOS-LS Brings the Future to Today's Joint Forces



## NLOS-LS Draft Restructured Program Plan

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\* ASSUMES FY05 REPROGRAMMING REQUEST **APPROVED** 

Spiral 1 Proc Qtys →

6

12

30

NLOS-LS PROCUREMENT PART OF UA





## Precision Attack Missile (PAM) Technical Requirements



#### GPS/INS Navigation System





#### Data Link

- JTRS Cluster V
- 2-Way Op in loopSoftware Programmable





#### Multi-Mode Seeker

- Semi-Active Laser (SAL)
- Un-Cooled Imaging Infra Red (UCIIR)





### Requirement

Maximum Range

Minimum Range

Target Set

Updates in Flight

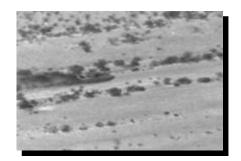
#### **ORD Threshold**

40 km

500m

High Value Targets (Armor)

Two-Way Comms w/ FCS
Network





PAM Provides A 40km Precision Kill Capability Against Hard and Soft Targets Using Laser Guidance or Automatic Target Acquisition



## UNCLASSIFIED Accomplishments















**Armor Entrance Hole** 



**Armor Exit Hole** 



Warhead Armor Test



Pre IM Frag Test



Post IM Frag Test





End to End Flight Test Successes



IR Seeker Images from Captive Flight Tests Against Land/Sea Targets





## Loiter Attack Missile (LAM) Technical Requirements



#### Data Link

- JTRS Cluster V
- 2-Way Op in loop



#### Jet Engine

Low Cost Turbojet



#### Requirement

Maximum Range (INF Treaty)

Minimum Range

Typical Range with Loiter (km)

Target Set

Updates in Flight

#### **ORD Threshold**

< 480 km

500m

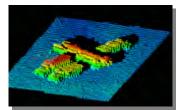
70km w/ 30 min loiter

High Value Targets (TEL/MRL)

Two-Way Comms w/ FCS Network

Automatic Target Recognition (ATR)

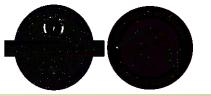








LAM Provides A Dedicated, Loitering Long Range Recon and Discriminating Point Kill Capability



## LAM Accomplishments



**Square Body Wind Tunnel Test** 



**Hot Engine Wind Tunnel Test** 



**Engine Static Tests** 



**Carbon Fiber Wing** 



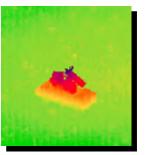
**Seeker Section** 



**Prototype Processor Board** 



**Captive Flight Test** 



LADAR ATR



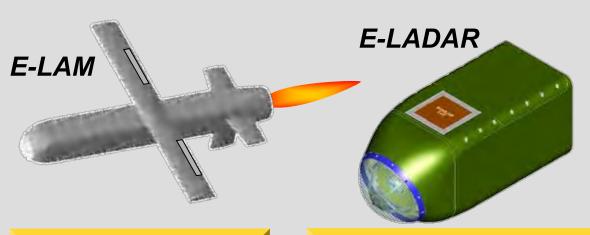
# Loitering Attack Missile (LAM)



#### What is the Status of LAM?

LAM Funding Removed from SDD Beginning in FY05 Due to Army Affordability Issues and Effort Shifted to Army S&T; Operational Requirement Still Valid

#### What is the Focus of LAM S&T Efforts?

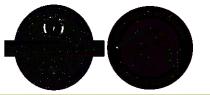


- Higher Maneuverability
- Efficient Searches
- Fly Through Stalls

- More Beams and Resolution for Greater Coverage
- Lower Cost, Higher Performance Laser by Shift of Components

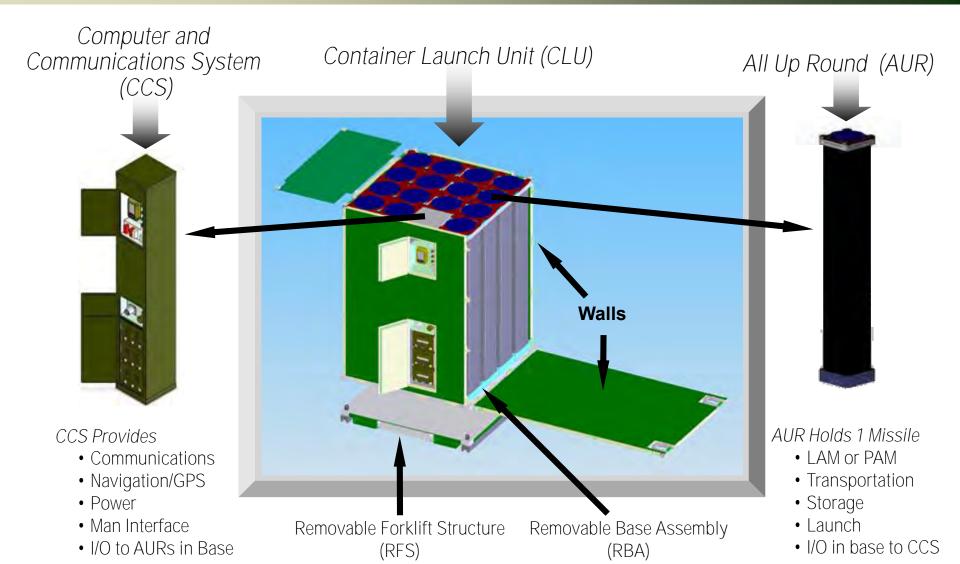


- Continuous View of Targets
- Wide Field of Regard Cueing



## SDD CLU Baseline Concept







# NLOS-LS Platform Independence





HIMARS Resupply Vehicle Chosen as NLOS-LS Platform for EBCT



Roll Off: Have 30 minutes prep time before mission



Roll Off: Immediate Mission



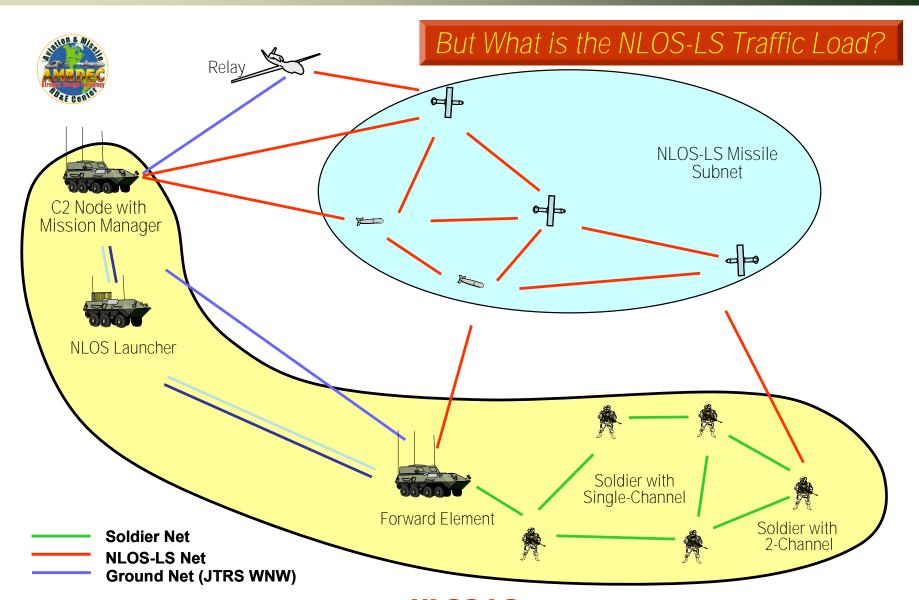
Helo Transport





## NLOS-LS Comms Architecture







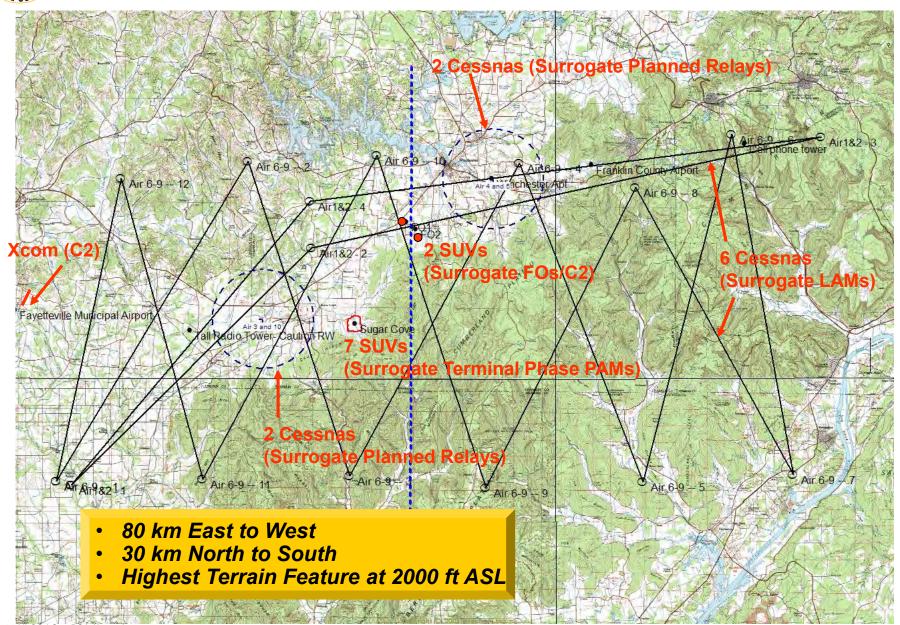
# First, we had to establish a baseline for the NLOS-LS traffic load: AMRDEC/Ft. Sill Simulation Experiments

- TRADOC-Approved:
  - FCS Scenarios
  - Force Structures
  - CONOPS
- ITT and Raytheon NLOS-LS Missile Subnets Explicitly Modeled
- NLOS-LS Mission
   Planners & Imagery
   Display Explicitly
   Played
- LAM & PAM Detailed Flight Models (Speed, Altitude, Turns, etc)
- LADAR and UCIR Seekers Explicitly Modeled
- IDEEAS & FIRESIM XXI Force-on-Force Models





## NLOS-LS Captive Carry Communications Test



## Networked Fires Using NLOS-LS STO (FY02-04) **Surrogate LAMs Surrogate PAMs** Surrogate **Ground Elements &** C2 Cell **Terminal PAMs** 20-Node, Beyond Line-of-Sight Comms Test Test Area (30 x 75 km) **Extends Up and Over** the Cumberland Ridge Control Node Located at Fayettevile, TN Airport Monitors all Comms Traffic in the 20-node Test **Performs Analysis of Network Performance** NL-0011 NLOS-LS to PSA (Apr 05)

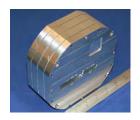
#### Purpose:

**Develop and Test Communications Networking for NLOS-LS Missiles** 

#### Products:

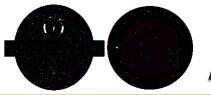
- Soldier Radio Waveform (SRW) Modified to Support NLOS-LS Missile Requirements
- Two Form-Factored, Prototype Missile Radios and a Missile Antenna
- Radio and Comms Software





#### Results:

- NLOS-LS Bandwidth Requirements Established and Proven for UA Operation
- Air-Ground Dynamic Network Tested and Proven
- Imagery can be Transferred Over Wireless Network Sufficiently for Operational Use

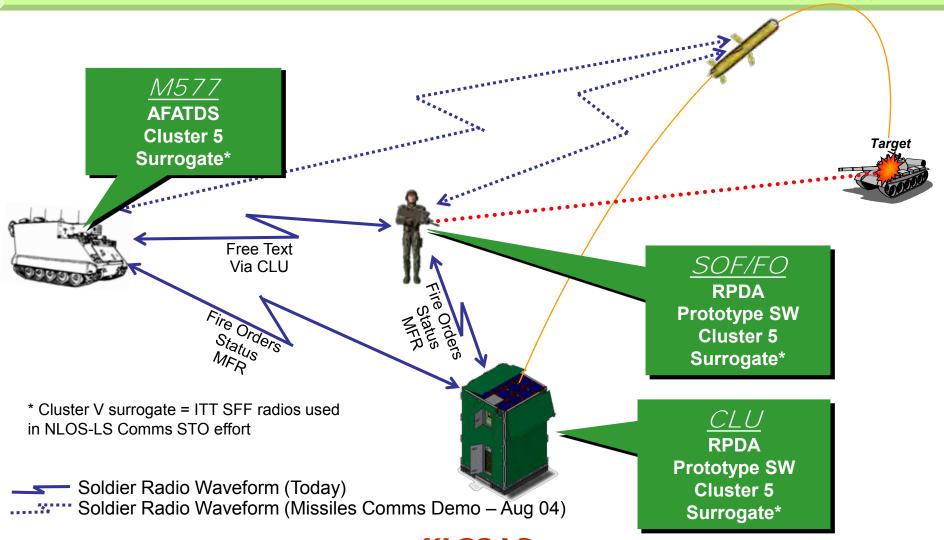


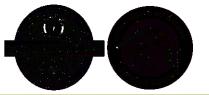
## NLOS-LS Ground Comms Demonstration - 18 Nov 2004

**UNCLASSIFIED** 



Successful Demonstration for PEO-TM with PM UA Networks, LSI and PEO C3T Participation





## NLOS-LS Supportability





- MBCT/UA's Logistics Support and O/S Costs Minimized
  - Soldier and Depot Level Maintenance Only
  - Line Replaceable Units (LRUs)
  - Common FCS Rechargeable Battery
  - Standard NATO Slave Connection
  - Limited Tools Required to Replace LRUs



- Fully Integrated Interactive Electronic Technical Manuals (IETM)
  - Embedded RPDA on CLU
  - Enables Training and Maintenance Without Additional TMDE or Manuals



- Predictive Logistics Increases Cdr's Flexibility
  - Embedded Platform Soldier Readiness System (PSMRS) Software feeds the FCS Network's Logistics Decision Support System (LDSS)
  - Provide Predictive Prognostics, Diagnostics, and Planning at All Levels of Command







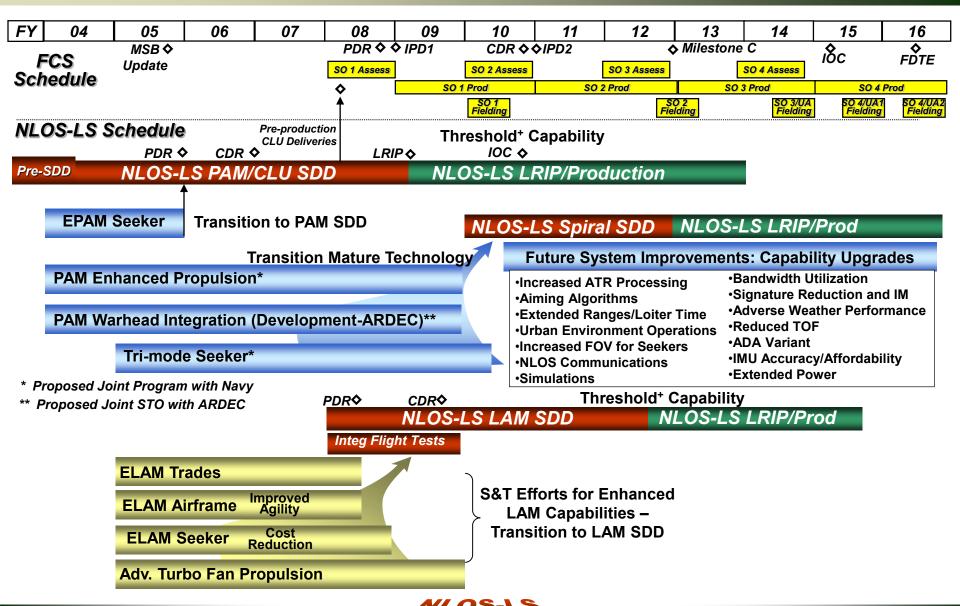
## NLOS-LS S&T Roadmap

**UNCLASSIFIED** 

## AMPDEC Strate of the strategy



#### Capability Upgrades - Spiral Development





# "Take-Aways" on NLOS-LS





- NLOS-LS is on Track for Spiral 1
  - PAM: Component Level Risks Have Been Addressed
  - CLU: Prototyping has Provided Great Insights into Power and Interoperability Activities



LAM Efforts Underway in S&T to Reduce Cost and Enhance Performance



- Joint Efforts Continue and Will Expand
  - Current Navy Funding on NLOS-LS Contract for Putting PAM on Littoral Combat Ships
  - Special Operations Forces have High Interest



- NLOS-LS Task Force Director Objectives:
  - Provide PAM Lethality to Current Forces ASAP
  - Get LAM Back on Track to Support Future Forces

NLOS-LS Brings the Future to Today's Joint Forces